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SECOND EDITION

RAISING

LIVESTOCK

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RAISING LIVESTOCK

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Preface

THE FIRST EDITION of "Raising Livestock" has been very favorably received. The second edition incorporates the most recent developments in such phases of livestock production as selecting, improving, feeding, and maintaining health.

The purpose of this book is to provide up-to-date information on raising livestock. Information is included on the most important activities involved in raising animals successfully on farms and ranches. Considerable emphasis is placed on activities helpful to persons interested in starting or improving herds and flocks of their own and in raising livestock for other persons.

This book is intended primarily for students of vocational agriculture and other youths on farms and ranches who are assuming new responsibilities in raising livestock. It should also be useful to adults already established in the business of raising livestock who are interested in securing better returns from livestock enterprises.

The materials were selected and arranged in such a way as to enable the reader easily to find specific suggestions for solving problems that confront him in various phases of raising swine, dairy cattle, beef cattle, sheep, goats, horses, and mules. Each chapter is organized around the major activities involved. For example, in connection with feeding livestock, appropriate materials are included on securing an understanding of the general principles and practices of feeding as they apply to all kinds of livestock. This is followed by a detailed treatment on feeding each kind of livestock. A similar plan of organization is followed in the other chapters.

Methods of producing livestock are given consideration and discussed throughout the book. Information is provided on approved practices of value in selecting, improving, breeding, feeding, housing, maintaining health, and the various other activities connected with the raising of livestock.

In addition to the activities involved in producing farm animals, at-

tention is also given to marketing livestock and livestock products and to preparing and processing livestock products for home use. Thus, this book provides a comprehensive foundation for all the important phases of a livestock business, with step-by-step directions on how to perform the jobs that need to be done.

The first edition of "Raising Livestock" appeared under the authorship of W. H. Peters and George P. Deyoe. Professor Peters, who was well known as a teacher and a writer in the field of animal husbandry and as a judge at livestock fairs in both the United States and Canada, passed away in 1949.

George P. Deyoe
W. A. Ross

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Foreword

AMERICA is the producer as well as the consumer and user of vast quantities of meat and other animal products. These products come from our ranches and farms, with smaller tracts of land contributing a good share in the total national livestock business.

Over a period of years, certain sections of the country have come to be definitely identified with particular kinds of livestock production —dairying, hogs, or beef, or sheep raising. Experience is proving, however, that a thorough knowledge of the conditions favorable to animal growth, coupled with intelligent management and careful handling of the animals, has the effect of extending areas in which livestock is produced. Livestock of various kinds, for example, is now raised successfully on a sizable scale in certain sections that in previous years were not prominently identified with livestock.

The raising of livestock is a business: it may be large or it may be small; it may involve one enterprise or it may involve several of them. Regardless of size or character, however, such a business is made up of a series of closely related activities or jobs that must be performed efficiently for success. Such a situation calls for skill and technical knowledge on the part of owner, manager, and caretaker. Practices followed are often a result of years of study and practical experience, some of which can be passed on to other persons interested in the same type of business.

The first edition of "Raising Livestock," which appeared in 1946, was a pioneer book because it was set up and developed entirely on the basis of activities as farmers and ranchers perform them. From the opening chapter, Engaging in the Livestock Business, to the final chapter, Preparing and Processing Livestock Products for Home Use, the pages revealed in logical sequence the important steps to take or decisions to make in each activity discussed.

The revised edition of this practical book is improved and expanded for the use of prospective and present farmers or ranchers. It includes both operative and managerial jobs. It is a book in which each activity

stands as a unit and where the information needed can easily be found It should prove equally helpful to persons making adjustments in existing livestock enterprises and to persons starting to develop a livestock business

Evidence that the authors are exceptionally well qualified to produce such a book is apparent throughout every chapter Professor Walter H Peters (deceased) brought to the original authorship broad experience having been identified with the Animal Husbandry Departments at Iowa State College Manitoba (Canada) Agricultural College North Dakota Agricultural College and the University of Minnesota For over twenty five years Professor Peters was Chief of the Division of Animal and Poultry Husbandry at the University of Minnesota

Professor George P Deyoe has been successively a teacher of vocational agriculture in a beef hog and dairy section of the Middle West, a member of the animal husbandry and agricultural education staffs at the Platteville (Wisconsin) State Teachers College where he was also in charge of the college herds and flocks and Professor of Education at Michigan State College and the University of Illinois Professor Deyoe has long been identified with agricultural education and has done considerable writing in this field

W A. Ross was born on a Colorado stock ranch and has farmed for himself He was successively a teacher of vocational agriculture and school superintendent in his native state and State Supervisor of Agricultural Education in Wyoming He has served as Subject Matter Specialist Consultant and in other capacities with the Federal Board for Vocational Education and U S Office of Education Mr Ross was for thirteen years National Executive Secretary of the Future Farmers of America Since 1942 he has been Consulting Editor for the McGraw Hill Rural Activities Series

The authors and publishers hope that this revised edition will enjoy a continued welcome among students of the livestock industry and among teachers responsible for courses designed to train or improve stockmen

THE PUBLISHERS

1. Engaging in the Business Livestock

BECAUSE of the value and usefulness of their products, the ease with which they are domesticated, and their adaptability to production on farms, several species of animals are commonly referred to as "farm animals" The list includes cattle, hogs, sheep, goats, horses, mules, and poultry All these animals can grow and develop under a variety of conditions and surroundings Many factors must be given consideration, however, in deciding whether or not to engage in livestock raising and whether or not a certain livestock enterprise should be made a part of the production program Additional factors must also be considered in choosing the kind of livestock to be raised, as well as the production methods best suited to the producer and to the individual farm or ranch Such factors are discussed in this chapter in connection with the following activities

1 Qualifying as a Livestock Raiser
2 Fitting Livestock into a Farm Business
3 Selecting Livestock Enterprises
4 Getting Started with Livestock
5 Developing and Improving a Livestock Program
6 Making a Success of Livestock Raising

1 Qualifying as a Livestock Raiser

Since this book is written primarily for the young person or the beginner who is raising livestock, rather than for the more experienced stockman, it is suggested that the individual, first of all, "take stock" of himself A young man may or may not have had opportunity or occasion to study himself as here suggested from the standpoint of his qualifications as a livestock raiser It is highly desirable that he do so before deciding whether or not to engage in such work While all the qualifications mentioned may not be absolutely essential in planning and operating a sound livestock program, many of the points discussed will be found helpful in caring for domestic animals anywhere

Some questions the beginner should ask in analyzing his personal qualifications are (1) Have I a strong liking for various kinds of animals or at least for one or two specific kinds? (2) Do I possess an even and moderate temper, patience and the perseverance essential in working with animals? (3) Am I willing when occasion demands, to work at night and on Sundays and holidays in order that the animals under my care may have necessary attention? (4) Am I interested in

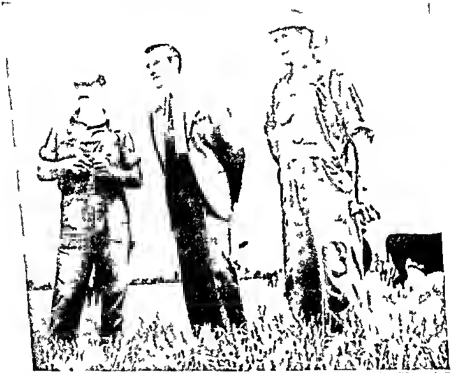


FIG 1 Livestock raising is an important part of agriculture in the United States The goal of becoming a highly successful livestock producer is a challenge to many This former student of vocational agriculture has an American Farmer degree in the Future Farmers of America He takes pride in showing a visitor the herd of cattle and flock of sheep that he owns in partnership with his father (*State Board of Control for Vocational Education Michigan*)

raising livestock only as a means of making money, or will I secure pleasure and satisfaction from the accomplishment of raising quality animals? (5) Am I willing to make a study of my work, profit by experience and improve as time goes on?

A Liking for Livestock Much has been said about the importance of a liking for livestock or love of animals, as a characteristic of the successful stockman It is true that a liking for animals or for the

specific kind of animal which one chooses to raise is important, for anyone will naturally do better the work he likes and enjoys. Animals are living beings, they move around, they have brains. While not capable of doing much thinking, they have instincts and traits of disposition and temperament that may lead to considerable understanding between them and their caretaker. Many animals develop a liking for a person who is kind to them. This can be observed as a caretaker goes about the stalls and pens doing the work of feeding and handling them. The caretaker may develop an understanding of the temperament and the likes and dislikes of animals with which he is working and become very much attached to them. The enjoyment many people get from association with animals is reflected by such well known sayings as "The dog is man's best friend" and "The horse is man's most willing servant."

Patience and Perseverance. A moderate, even temper, unlimited patience, and perseverance are great helps in working with animals. The proper care of domestic animals usually requires that they be handled in getting them in and out of barns, moving them from one lot or pasture to another, caring for them when sick or injured, and loading them into freight cars or trucks. Most animals are naturally shy. Their instinct tells them to beware of new surroundings or changes in their daily routine. They react slowly to attempts to teach them to do things they have not done before. The successful animal raiser must have a thorough appreciation of these mental limitations in animals. A good slogan when working with or handling animals is "Make haste slowly." Attempts to force an animal to do something it does not want to do usually result in failure. Moreover, the attempt to hurry an animal may cause it to become confused, frightened, or angry.

Handling animals, smoothly and without confusion, requires that they be "outsmarted" rather than "outfought," that they be "outwaited" rather than compelled to hurry. Using a short hurdle instead of a stick in driving pigs and backing a stubborn animal through a strange door or into a truck when it refuses to be led in are examples of man taking advantage of the lower intelligence of animals. This ability to "outsmart" animals and prevent confusion in handling them is sometimes referred to as "animal sense," meaning an understanding of animal mentality on the part of the handler. It is not expected that the average beginner will possess a great amount of animal sense, but

the most successful livestock raisers develop it. They make every effort to maintain an even temper and to use patience and perseverance while handling animals.

Willingness to Give Regular Attention. Most of the work involved in the raising of animals does not require heavy physical exertion. This is especially true if intelligent thought is given to the planning and arrangement of pastures, yards, buildings, and equipment. Such planning makes for convenience when coupled with a wise use of labor and laborsaving devices and practical arrangements for carrying out

FIG. 2. Willingness to give regular attention pays dividends in raising livestock. This student of vocational agriculture has a good start in hog raising. (*L. I. Samuels, Arlington, Texas.*)

the work. The most undesirable feature in connection with the raising of livestock is that animals must have regular attention. In many instances they must be fed twice a day. In the case of milk cows, they must be milked twice a day, 7 days a week, and 365 days each year.

The successful feeding and care of dairy cows require that they be fed and milked at somewhere near the same hours each day and at intervals dividing the 24-hr. day into two periods about equal in length. Were the two daily feeding and milking periods to be divided by two equal 12-hr. intervals, it would mean that the first feeding and milking should begin around 5 o'clock in the morning and the evening work at 5 o'clock in the afternoon. Since livestock raising is often

combined with other farm operations, as a usual practice during the summer months the morning feeding and milking are begun about 5 o'clock. Because the available labor is used for work in the fields during the day, evening feeding and milking are often done after supper, beginning about 7 o'clock. This makes a long workday during the summer with the daytime period between feeding times about 14 hr. and the night period 10 hr. In winter, the morning feeding is likely to begin at 6 o'clock and the afternoon period at 4 o'clock; this makes a 10-hr. daytime period between feedings and 14-hr. night period.

Obviously, in the management of a livestock enterprise, it is difficult to get away from a long working day or at least a "broken day." A broken day means that the person who begins work at 5 in the morning would work, say 2 hr. before breakfast, then about 2 hr. until 10 o'clock, and then begin again at 2 o'clock in the afternoon and work until 6. Thus, he would put in a total of only 8 hr. a day at work. This plan or one similar to it, reducing the time at work to a 9- or 10-hr. day, is used on many large, specialized livestock farms where several men are employed. On such farms, the men who care for the livestock do not work in the fields.

The fact that livestock must be cared for every day in the year presents a continuous labor problem, especially if the farm is a small-sized one-man farm. In this case, the work becomes extremely confining, and it is difficult for the stock raiser ever to get full time off on Sundays or holidays or to have a vacation. This problem is more easily solved on farms or ranches large enough to justify the employment of several persons. Here the work can always be arranged so that it can be made lighter on Sundays and holidays and for longer periods to allow for vacations. In this way, workers may have a day off each week and a reasonable vacation period each year.

Attitude toward Livestock Enterprises. Farming and ranching in general have often been described as something more than just an occupation or business. They have been called a "way of life," meaning that, besides being the place of business, the farm or ranch is also the home. Home, family, and social life become very closely tied in with the everyday activities of operating the farm or ranch. Because of the daily attention required throughout the year by the animals, livestock raising does become the way of living for the operator. Certainly, a livestock enterprise should be looked upon first of all as a source of profit and a means of increasing the income. No one except a person

of considerable wealth can afford to enter livestock raising with any objective other than that of making money On the other hand, to enter into the business of raising livestock with the hope that it offers an opportunity to get rich quickly is likely to lead to disappointment In normal times, financial profit from raising livestock is reasonably sure and steady The sound, profitable method of developing a large enterprise is to build the enterprise slowly and cautiously from a modest start This means that considerable time is required to build a large,

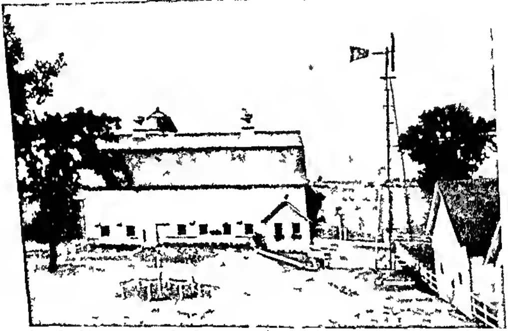


FIG 3 The operation of a farm or ranch is much more enjoyable when pleasant surroundings are maintained This attractive dairy farm near Union Ill was named 'Grand Champion Neat Farm of the Chicago milkshed This honor was won by the exceptional cleanliness of every building inside and out clean equipment the general orderliness of the fields and farmstead and the healthy condition of the dairy herd (*Pure Milk Association Chicago*)

profitable herd of animals The beginner who is misled into anticipating quick or large returns from a small start is likely to become disappointed and may even lose interest entirely before he has had time to succeed

Willingness to Adopt New Methods To be successful, a stockman must be constantly on the alert for procedures and practices that will improve his business Unless a person is willing to study and adopt new and improved methods, profit by his own experiences, and utilize

the experiences of others who are successful, he should probably not engage in raising livestock.

2. Fitting Livestock into a Farm Business

Farm animals are raised in the United States because they contribute products and services that are useful and profitable to mankind. Many of these products cannot be secured from any other source, nor are suitable substitutes for them available. The great demand for animal products makes it possible to increase the income from many farms by fitting one or more livestock enterprises into the over-all management and operation plan.

Obtaining Important Products from Animals. Farm animals contribute to the welfare of mankind by producing food, clothing, power, or recreation. Of all the contributions made by animals to the welfare of man, food is the most important. Nearly one-half of the total human food supply is contributed by animals. Important food products secured from them include meat, milk, butter, cheese, and eggs. All are highly concentrated foods, easily digested, healthful, and well liked by most people. Although the several food products of animal origin are similar in food value, they differ widely in form and taste. It is because most people like variety in their food that they prefer to eat some of each of the different kinds of meat and other animal products.

Table 1 shows the average, annual per capita consumption of food

TABLE 1. ANNUAL PER CAPITA CONSUMPTION OF FOOD PRODUCTS OF ANIMAL ORIGIN IN THE UNITED STATES, 1946–1950*

KIND OF FOOD	POUNDS
Pork	70 1
Beef	63 9
Veal	9 3
Mutton and lamb	5 0
Fluid milk and cream	395 4
Ice cream (net milk used)	46 0
All cheese	7 0
Condensed and evaporated milk	19 7
Butter	10 6

* Data from U S Department of Agriculture.

products of animal origin in the United States during the 5-year period 1946 to 1950. When one considers that there are more than 166,000,000 people in the United States, he may be sure that there is almost unlimited opportunity to raise domestic animals that provide important articles of human food. Cattle, hogs, sheep, goats, and chickens yield

Fig 4 Success in livestock production means starting with good foundation animals and growing into the business These two boys have selected high quality female animals for their livestock projects in vocational agriculture (*Upper photo Department of Agricultural Education Ohio State University*)

important food items Therefore these animals offer opportunity to anyone who can succeed in raising them efficiently

In earlier times before people had learned to make clothing from fiber they probably considered animals of greater importance for the skins they produced that were used for clothing than for their food

products. After man learned to make cloth from cotton, silk, wool, and other fibers, clothing from animal skins became of secondary importance. It is true today, however, that nearly all footwear and some clothing are made of leather and much clothing is made of wool. Not so many years ago, sheep could be raised profitably for the wool they produced. Now, even wool is of secondary consideration, while meat is of first importance. This in no way detracts from the value of animals as a source of clothing but serves to point out the fact that clothing must be considered as a secondary product, rather than the product of first importance, in all livestock production.

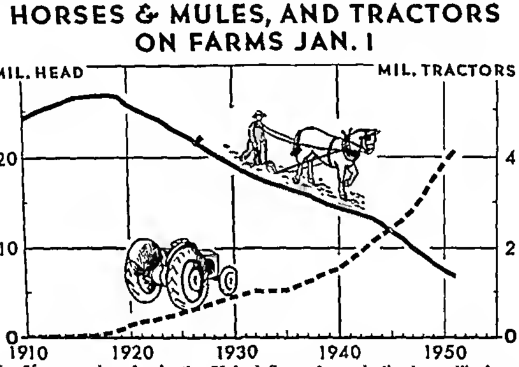


FIG. 5. Horses and mules in the United States have declined steadily in number since 1920; horses more rapidly than mules. However, horses and mules still do all of the work on some farms and part of the work on some farms where tractors are used. Tractors have increased greatly in number as a source of farm power. (*Bureau of Agricultural Economics, U.S. Department of Agriculture.*)

Horses, mules, cattle, buffaloes, elephants, reindeer, camels, goats, and dogs have all been domesticated as sources of power for various purposes. Preceding the steam engine, electric motor, and gasoline engine, animal life provided man's only source of tractive power other than himself. Except during the last century, animal life contributed practically all the supplementary power to man for transportation, construction, and tillage of the soil. Because of their intelligence, docility, speed, endurance, and low cost of maintenance, horses and mules displaced nearly all other animals as a source of power, especially in the more highly civilized countries. In parts of the world, cattle,

elephants, camels, and dogs are still extensively used as sources of power The use of horses and mules for power reached its peak in the United States in 1920 Since then, rapid replacement, largely by tractors and trucks, has caused a marked decline in the use of horses and mules for power In 1951, there were in the United States, principally to provide power for farm operation, about 6,750,000 horses and mules as contrasted to the maximum number of 26,742,000 horses and mules in 1920 In this period, tractors increased from about one-fourth million to more than four million (See Fig 5)

Everyone is familiar with the contribution of wild animals to recreation through hunting and fishing Wild animals also contribute to the supply of food and clothing, and fish to the supply of food The dog contributes much to recreation Horesback riding is a favorite recreation, and horse racing is still the king of sports

Increasing Income. Animals may help to increase the income from farms and ranches This is accomplished by (1) changing field crops into animal products of greater usefulness and value, (2) changing grass and other growth from nontillable grazing land into useful animal products, (3) changing many otherwise useless by-product materials into useful animal products, (4) providing a more even distribution of labor, (5) contributing important items to the family food supply at low cost, and (6) conserving soil fertility.

Many cultivated crops, such as wheat, rye, oats, barley, and corn, either can be used directly as human food or can be fed to animals A number of these crops are grown in such abundance in the United States that only a small part of the annual production can be used through direct consumption by humans When fed to livestock and converted into animal products of greater usefulness and higher value, these surpluses bring a higher price

In many parts of the United States, vast areas of mountainous land are too rough to be cultivated or have insufficient rainfall to grow cultivated crops profitably Scattered throughout the more fertile areas of the country there are many small patches of land that are hilly, rocky, or otherwise unsuited to profitable cultivation Nature has covered these lands with vegetation, largely grasses, which can be grazed by cattle and sheep and thus converted into valuable animal products Such areas contribute annually an immense amount of feed for livestock

By-product feeds are of two kinds, those produced on the farm

and those resulting from the processing of feeds. By-product feeds from the farm include such materials as straw, corn fodder, beet tops, cull potatoes, and skim milk. By-product feeds from manufacturing processes result from the extraction of oil from flaxseed, soybeans, cottonseed, and corn; bran and middlings from the manufacture of flour from wheat; molasses and beet pulp from the sugar industry; tankage, meat scrap, and bone meal from the meat-packing industry; skim milk, buttermilk, and the dried milk products from the dairy industry; and fish meal from the fish canneries. The by-products just

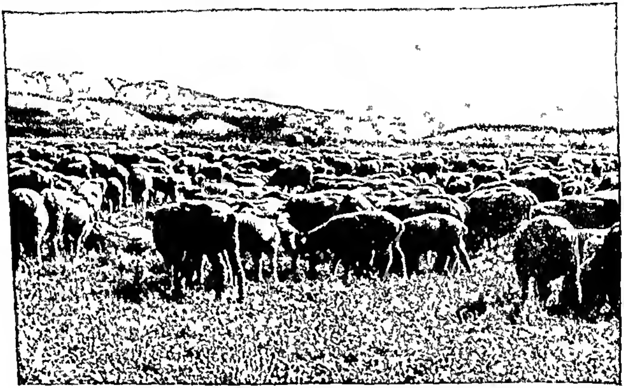


FIG 6 In many parts of the United States, there is land suited primarily to grazing These range ewes and lambs are grazing in June on western foothill pasture. As soon as the snow leaves the higher altitudes, the flock will be moved to the grazing grounds thus made available (*Western Sheep Breeding Laboratory, Dubois, Idaho U.S Department of Agriculture*)

mentioned have little value except as feeds for animals. By changing such materials into feed products for livestock, farm animals salvage from them a vast amount of wealth

Efficient year-round utilization of hired labor is an important item in the successful management of any farm or ranch. Efficient utilization of his own time and utilization of the time of children after they are old enough to contribute productive labor are of real importance to the small farmer. Livestock enterprises add to the labor requirements of the farm, but they also provide a cash return for the

labor Most types of livestock raising require considerable labor during the winter months Thus, in livestock farming, the labor is available for crop production during growing and harvesting seasons while the livestock is taking care of itself on pasture Labor is better utilized and more regular attention is given to the livestock through the winter months

By maintaining the necessary number of milk cows, hogs, and poultry on a farm or ranch, a plentiful supply of milk, cream, butter, pork, lard, poultry, and eggs can be made available at cost of production This appreciably reduces the amount of food that must be purchased for the family table and makes possible a substantial saving in the annual food cost

Conserving soil fertility is an important consideration in planning for the continuation of profitable farming When crops are sold directly off the land, a heavy drain on the fertility in the soil is made each year When animals or animal products are sold, a large part of the fertility taken from the soil by the plant growth remains on the farm as manure and is therefore returned to the land When animals or animal products are marketed, only that part of the plant growth which is assimilated by the animal is sold Through saving the manure and returning it to the land, the fertility of the farm will be reduced more slowly than if the entire crop is sold as plant products Many farmers buy feed to supplement that produced on their own farms If sufficient feed is purchased, more fertility may be returned to the land each year than is taken from it In this way, a run down farm can be brought back to a high state of fertility through livestock raising

Determining Opportunities in Livestock Raising Considering the items contributed by animals for the use of people and the several ways in which producing them may increase the income from a farm or ranch, it is evident that there is need for a large livestock industry in the United States For the present population of over 166 000,000, the United States is able to produce enough animals and animal products of all kinds to supply domestic needs and also leave some products for export The one exception to this statement is that for many years one fourth to one half the amount of wool needed in America has been imported

Some of the reasons why the United States has been able to keep pace in livestock production with the needs of its increasing population are (1) the vast area of rich soil, (2) climatic conditions throughout

the entire country favorable to economical care and maintenance of animals; (3) improved methods of crop production, which have made possible abundant feeds suitable to different kinds of farm animals; and (4) improved methods of breeding and raising livestock, which have led to increased production from them. The need for animal products is so great and the opportunity for their profitable production is so large that the income from the great majority of farms and ranches is the highest when livestock is included.

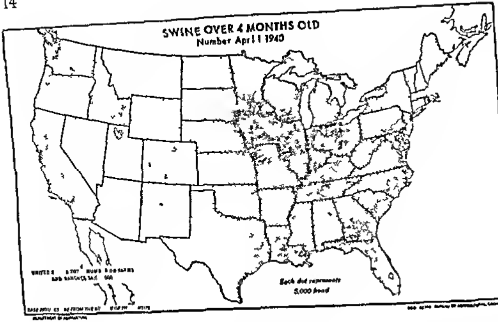
3. Selecting Livestock Enterprises

Whether or not to undertake the raising of any livestock at all, what kind to raise, how many head to raise, and what specific production plan should be followed are questions that must be decided by each farmer or rancher according to his individual desires, his abilities, and the suitability of his specific farm or ranch to one or more kinds of livestock enterprises.

Making Regional Adaptations. The area or region of the country in which one's farm or ranch is located is a factor in determining the kind of livestock that can be produced to greatest advantage. Both the natural and economic conditions that influence success and profits from livestock raising are often regional in character.

To illustrate, the Corn Belt states of the Mississippi Valley region of the United States are especially suited to the raising of hogs because the natural conditions of climate, topography, and soil are favorable to abundant production of corn, which is the best basic feed for hogs. Dairy cattle have long been considered the kind of livestock most likely to prove profitable in the Northeastern states, partly because several large cities are located within this area. These cities provide a steady and sizable market for fresh milk and cream. Because milk and cream are bulky and at the same time perishable products, there is an economic advantage in producing milk as close as possible to the consuming centers. Besides this economic factor favoring dairying in the Northeastern states, there is also a natural factor involved. The climate, soil, and topography favor a luxuriant growth of grass, which dairy cattle can utilize more efficiently than any other kind of farm animal.

In the large, semiarid, and mountainous region of the West and Southwest, beef cattle and sheep have both a natural and an economic advantage. The natural advantage is that they are better adapted



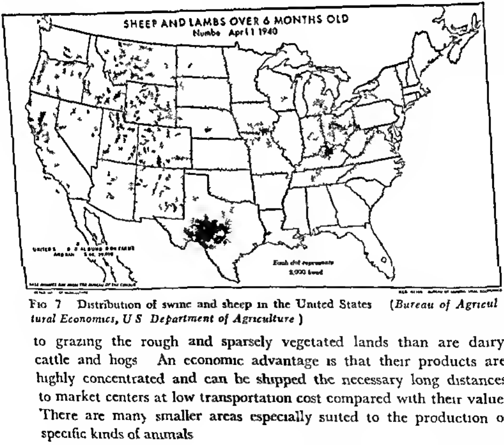
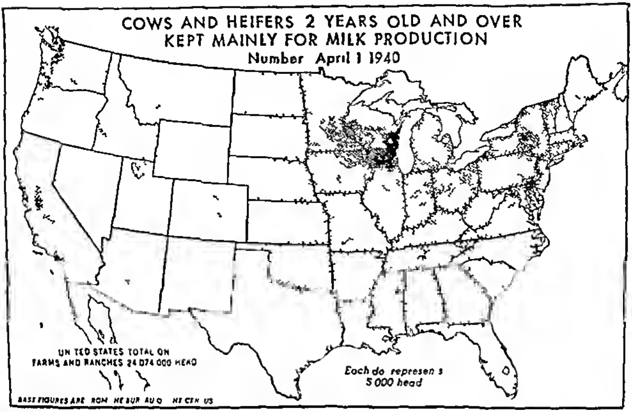


Fig 7 Distribution of swine and sheep in the United States (*Bureau of Agricultural Economics, U S Department of Agriculture*)

to grazing the rough and sparsely vegetated lands than are dairy cattle and hogs An economic advantage is that their products are highly concentrated and can be shipped the necessary long distances to market centers at low transportation cost compared with their value There are many smaller areas especially suited to the production of specific kinds of animals



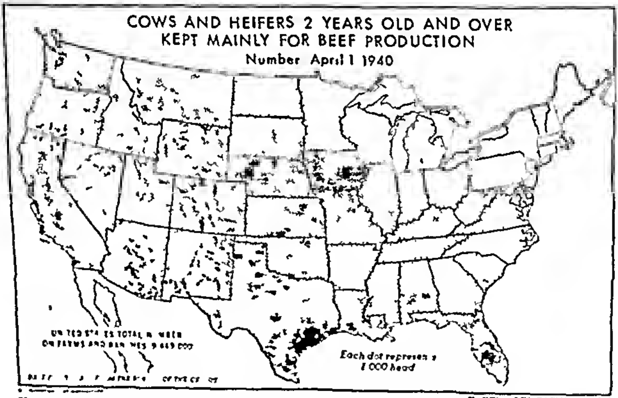


Fig 8 Distribution of dairy cattle and beef cattle in the United States (*Bureau of Agricultural Economics U.S. Department of Agriculture.*)

Although regional advantages or disadvantages should always be given careful consideration in selecting the kind of livestock to raise, keep in mind the fact that some regions are equally well suited to two or more kinds of animals An illustration of this is the suitability of the semiarid regions of the West and Southwest to the production of either beef cattle or sheep, as indicated in the preceding paragraph. An even broader illustration is the suitability of the Corn Belt region to almost any kind of livestock enterprise Although hogs have a

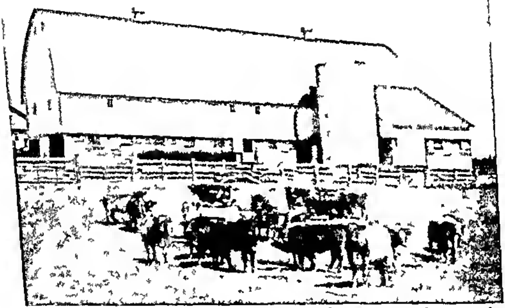


FIG 9 The buildings and equipment already on a farm sometimes determine the kinds of livestock to be raised This large barn is especially suited to housing a breeding herd of beef cattle (*The Shorthorn World*)

slight advantage in the Corn Belt, beef cattle, sheep, and poultry are also produced to distinct advantage

Analyzing Opportunities on a Specific Farm or Ranch It has been pointed out that regional characteristics, in some instances, may be an important factor in choosing the kind of livestock to raise It has been pointed out that some regions are equally well suited to the raising of several kinds of animals A further search for factors that influence profitable production reveals the fact that the specific farm or ranch must be examined for special suitability to one or more kinds of livestock Important factors are (1) acreage in the farm or ranch, (2)

buildings, fencing, and equipment already on hand; (3) productivity of the land; (4) proportion of the farm suited to the production of cultivated crops; (5) the kind of crops best suited to the land; (6) capital available for operating expenses; (7) amount and kind of labor available; and (8) opportunities to market the product.

Usually, it is the combined influence of several factors that suggests the kind of livestock best suited to a farm or ranch. For example, 160 acres would be considered an average-sized farm in many states. A 60- to 80-acre farm might be a small farm. A size of 320 to 480 acres would constitute a moderately large farm. On first thought, a breeding herd of beef cattle or a flock of ewes might seem a livestock enterprise adapted to the large farm because these two types of animals require comparatively small amounts of labor. However, if all the land on the large farm is highly productive and suited to cultivation, it would be advisable to raise cultivated crops, rather than allowing so much of the farm to remain in pasture. This might suggest the raising of a large number of hogs or the fattening of purchased feeder cattle or lambs as enterprises better suited to conditions than the maintaining of a dairy herd, beef herd, or flock of ewes. If, on the other hand, half or two-thirds of the land was suited only to permanent pasture, comparatively little corn or grain could be produced and the farm would be better adapted to the beef-cow herd or the ewe flock.

If combined with the large farm having a high percentage of grazing land there was a large amount of low-cost labor, the maintenance of a good-sized herd of dairy cattle would be indicated.

The small farm, even though the soil be highly productive, suggests dairy cattle as the means of making full utilization of the labor.

High-production capacity for corn or small grains suggests a hog enterprise as suited to either the small or the large farm.

In the semiarid or ranch area, certain characteristics, such as level land with a moderate to heavy growth of grass, suggest beef cattle as the kind of livestock. Rough, mountainous land suggests sheep.

Limited capital and limited equipment on the Corn Belt farm suggest hogs or poultry. Limited range area and limited capital suggest sheep rather than cattle for a ranch enterprise.

4. Getting Started with Livestock

The development of any livestock enterprise to a desirable size requires either considerable capital with which to make a substantial

initial investment in animals or the passing of considerable time to permit slowly "growing" into a worth-while enterprise from a small start. There are always mature men who have accumulated considerable capital from other sources who may, if they choose, establish a sizable livestock enterprise in a short time by making the large investment necessary at the start. There are circumstances under which the quick method of getting started would be advisable. Such circumstances will be pointed out later.

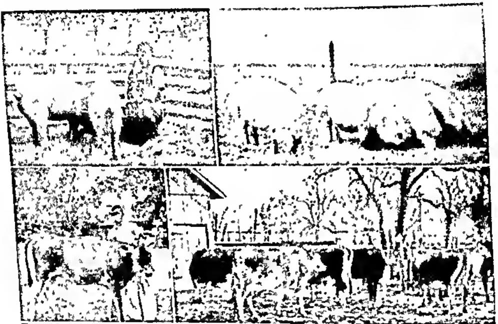


Fig. 10. A modest start and a genuine liking for livestock led to the successful development of swine and dairy herds by this young farmer in Illinois. *Upper left,* two gilts produced by the foundation sow; *upper right,* brood sows produced from the two gilts; *lower left,* a foundation heifer; *lower right,* the dairy herd a few years later. (*H. P. Erwin, Illinois.*)

Growing into the Business. A young person usually will not have much capital at his disposal. It is therefore necessary for him to start in a small way and "grow" into the business through the necessary period of time. This characteristic of livestock raising suggests the advisability of the boy who has made up his mind that he wants to raise some livestock starting in a modest way. During his school career he can become the owner of a cow, a few ewes, a sow, or some poultry and build from this point. Examples of how this has actually been accomplished are shown in Figs. 4 and 10. When the father of such

a boy is cooperative, an enthusiastic interest in becoming a successful livestock raiser develops. In many instances, a satisfactory partnership arrangement is brought about, which shortens the period usually necessary for a young man to become satisfactorily established. This partnership may continue for years. Should the boy wish to start farming on his own account, however, even a short period of partnership means that he has a good start in a worth-while livestock enterprise. Without borrowing too much money or starting at the very beginning and waiting several years for his livestock enterprise to pay worthwhile dividends, the young livestock man is on his way.

Although a start in livestock raising with a small number of females may be made at any time with little risk of serious financial loss, many factors influence such a decision and should be given consideration. The same is true in starting a sizable enterprise, deciding to expand or reduce holdings, and in developing the management plan to be followed. Three important factors that should be given particular emphasis at the time of starting in the livestock business are (1) production, price trends, and cycles; (2) the time element; and (3) personal likes and dislikes.

Making Use of Trends or Cycles. "Cycles of production" and "price cycle" are phrases often used in discussions of trends in the production of livestock. The production cycle implies an increase in numbers of animals, followed by a decrease, as shown in Fig. 11. A *complete cycle covers a period of years, starting with a low point in* the number of animals of a given kind being produced annually in the country, continuing until a high point is reached, then decreasing to another low point.

A cycle operates in the same way, relative to prices. The production and the price cycles are closely related. As production increases, price decreases; as production decreases, price increases. It is a reduction in numbers of animals that causes price to increase. It is advancing prices, together with low costs of feeds, that cause numbers to begin increasing again. For several years, numbers of animals and price may both be on the increase, but soon the numbers reach the point of oversupply. This situation always halts the price increase, and the price begins to decline.

For a time, numbers and price may both be on the decline, but soon the numbers reach so low a point that there are not enough animals to supply the demand. The price decline is halted and starts upward

again. This soon has the effect of stopping the decline in numbers, animals begin to increase again, and another cycle is started. The production and price cycles for farm animals are not long. For hogs, a production and price cycle may be completed in a period of about 5 years. The beef-cattle cycle usually covers 12 to 15 years. Figure 11 shows definite production cycles for hogs, beef cattle, and sheep as they have occurred in the United States during the last 50 years.

It is easy to see that the production and price cycles are important factors influencing the success and profit derived from a livestock

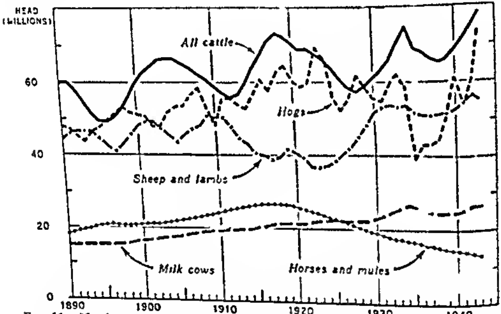


FIG 11. Numbers of each kind of livestock in the United States fluctuate over a period of years. These cycles appear more or less regularly for cattle, hogs, and sheep. A cycle extends from one high point to the next. *(Bureau of Agricultural Economics, U.S. Department of Agriculture.)*

enterprise. Should a person establish a livestock enterprise on a large scale by purchasing a large number of animals at just about the time prices had reached a high point, or the peak, of a cycle, the venture might prove disastrous because of declining prices during the years immediately following. If possible, it is always desirable for the livestock raiser to start at or near the low point of the price cycle rather than at or near the high point. Stockmen have been advised that the time to buy is when everyone else wants to sell and the time to sell is when everyone else wants to buy. Few men have the courage to

enter a business when everyone else wants to get out of it, and few have the courage to sell out or reduce production materially when prices are high and profitable. Nevertheless, such a procedure is about the best general advice that can be given the livestock raiser in order to "beat" the price-cycle problem.

National and state "outlook conferences" are conducted annually by and through representatives of the U.S. Department of Agriculture.

FIG 12 Boyd Waite (*left*) and Kenneth Waite of Winfield, Kans., present a pair of Hereford cattle from their purebred herd of 200 animals These men started with Hereford cattle while students of vocational agriculture On leaving high school, they entered a partnership with their father Later the father withdrew, and Boyd and Kenneth operated the home farm of 1,280 acres by themselves Both young men were awarded the American Farmer degree in the Future Farmers of America (*A P. Davidson, Manhattan, Kans*)

The results of the studies that have been made and the opinions of experts as to supply, demand, and price are available to stockmen and agricultural workers through printed bulletins, market releases, and newspaper articles. Such carefully compiled forecasts deserve the attention of every livestock raiser and should help to guide him in his operations.

Planning in Terms of the Time Element. The importance of time in livestock raising has been suggested in the discussion of the effect

of the cycles of production and price upon time to buy and sell The importance of time was also emphasized in the statement that it is wiser to 'grow' into the livestock business than to "go" into it Time is of greater importance in planning to start certain livestock enterprises than with others Dairying for example, is necessarily a long time enterprise Possible profits from it never mount so rapidly or to such a point that one might go into it on a large scale for a short time, make big profits and get out again This is because dairying on a large scale requires a large investment in cattle, buildings, and equipment Profitable dairying therefore is essentially a long time enterprise and one that cannot be gone into and got out of quickly The same is true of building a large herd of beef cows or a flock of breeding ewes Reproduction of these animals is too slow to permit taking advantage of sudden price rises of short duration The best that the dairyman, the beef cattle raiser, or the sheep flockowner can hope to do in taking advantage of time is to reduce breeding herds at times when he knows prices are high and allow them to increase in numbers during periods of low prices

There are some livestock enterprises, however, that can be increased or decreased more rapidly than those just mentioned In these, the skillful operator can increase or decrease production more drastically to take advantage of the time element for profit making Swine and poultry are the best examples Increased numbers require a small investment in breeding stock and equipment, and a short period of time is required from the mating of the animal to the marketing of the finished product Such enterprises as the fattening of purchased feeder cattle or lambs are also short time livestock enterprises that may be carried out with a comparatively small investment in buildings and equipment

Money may be made quickly by conducting the short time enterprises on a large scale provided that the operator is clever enough or fortunate enough to 'hit the jack pot' In other words he should try to go in when prices are low and try to get out when they are at the peak of a cycle Such a procedure generally requires a large amount of borrowed capital and is hazardous even when planned and carried on by a thoroughly experienced previously successful operator Even experienced operators engaging in the short time production enterprises generally prefer to plan operations on a long time, even basis Thus they risk no more than modest expansion when prospects

for increasing profits appear favorable and modest curtailment when prospects are less promising

Weighing Personal Likes and Dislikes. One need not visit with many livestock raisers, some of whom raise one kind of livestock and some another, to learn that each usually has a strong liking for the kind of livestock he is raising This extends even to animals serving the same purpose but of different breeds A liking for the kind of livestock one chooses to raise is often cited as one of the most essential requirements for success It is probable that many young people develop a liking for a certain kind or breed of animal because they have been raised on a farm on which success was had with that specific kind of animal Unsuccessful efforts in like manner tend to develop in the mind of a young person a dislike for the specific kind of animal Whether a liking for a specific kind of animal contributes materially to success in raising it or whether success develops the liking is open to argument In any event, if a young man has a strong liking for a certain kind or breed of animals, he should give that factor thorough but fair consideration in selecting a livestock enterprise and building a livestock program

It was pointed out earlier in this chapter that there are regional limitations to the most profitable production of each of the different kinds of livestock To a lesser extent, this also applies to the different breeds of livestock There are also individual farm or ranch limitations as to the adaptability of the different kinds of animals due to many differences in soil, topography, building and equipment, and the like These must all be considered first, then if it is found that the farm or ranch is equally suited to any one of several kinds of livestock, the owner or operator is free to select the kind or breeds he likes best

5 Developing and Improving a Livestock Program

Regardless of the livestock enterprise chosen and the manner in which it is started, the successful livestock raiser must ever be on the alert to make changes in his management plan that will improve upon the results secured Typical changes may involve such items as the crop grown, pasture management, methods of breeding, methods of feeding, and methods of marketing animals or the products from them New information is constantly available that may not only suggest but also necessitate changes in both plans and procedures if the livestock enterprise is to continue to be successful and profitable

GROWING ' INTO LIVESTOCK RAISING

Production project	Classification	In day school				Out of school		
		1st year	2d year	3d year	4th year	1st year	2d year	3d year
Purebred swine	Major	2 gilts	1 sow 3 gilts	2 sows 4 litters	2 sows 4 litters	4 sows		
Purebred dairy	Major		1 heifer	2 heifers	1 cow 2 yearlings	3 cows 2, 2 year-olds 3 heifers 1 bull		
Potatoes	Minor		1 1/10 acres	1 5/6 acres	1 3/10 acres	1 1/3 acres		
Melons	Minor			3/4 acre	1/2 acre			
Soybeans	Minor	2 acres						
Sudan grass	Contributory			1/2 acre	1/2 acre	1 acre		
Rape	Minor	1/2 acre	1/4 acre	1/2 acre	1/2 acre			
Corn	Minor		1 3/10 acres			6 acres		
Improvement projects		Kept farm accounts Reseeded pasture	Kept farm accounts Moved sheds	Kept farm accounts Set out forestry seedbed Built new fence	Kept farm accounts Set out forestry seedbed Painted farm buildings	Kept farm accounts Set out 500 trees Planted shrubs		
Supplementary farm practices		Treated seed wheat for smut	Culled poultry flock Treated poultry for lice	Fitted sheep for show Sprayed orchard	Castrated beef calves Fitted hand tools	Caponized cockerels		

FIG 13 This program of a student of vocational agriculture in the Ohio River Valley, although successful, indicates a shortage of grain and forage to support the livestock included (*Vocational Division Bulletin 225, U.S. Office of Education*)

"GROWING" INTO LIVESTOCK RAISING

Production project	Classification	In day school				Out of school		
		1st year	2d year	3d year	4th year	1st year	2d year	3d year
Beef	Major	9 head	9 head	17 head	22 head			
Registered sheep	Major	10 head	20 head	22 head	28 head			
Registered horses	Minor	4 head	3 head	4 head	4 head			
Swine	Minor		4 head	7 head	10 head			
Tobacco	Minor	1 acre	1/3 acre	2½ acres	5 acres			
Potatoes	Minor	¼ acre		½ acre	½ acre			
Corn	Contributory			15 acres	8 acres			
Lespedeza	Contributory	1 acre	1 acre	2 acres	3 acres			
Improvement projects		Set shrubs Set 3 acres of forest	Set shrubs and trees	Built drives	Painted the house			
Supplementary farm practices		Culled poultry	Caponized poultry	Tested milk Built poultry appliances	Pruned fruit trees Sprayed fruit trees			

FIG 14. This program of a student of vocational agriculture in the mid South area shows him to be a little slow in starting to raise corn in view of the number of hogs, beef cattle, and horses in his projects The projects show good distribution, with strong majors for this particular area The horses were standard bred show stock (*Vocational Division Bulletin 225, U S Office of Education*)

"Growing into Livestock Raising"

Product on project	Classification	In day school: 1st year	2d year	3d year	4th year	Out of school: 1st year	2d year	3d year
Sheep	Major	45 head	57 head	51 head	52 head	74 head		
Swine	Minor					28 head		
Colt	Minor					1 head		
Dairy calves	Minor					4 head		
Potatoes	Minor		2 acres					
Alfalfa	Contributory		14 acres	12 acres	17 acres	14 acres		
Sudan grass	Contributory		2 acres		5 acres	6 acres		
Rape	Contributory		1 acre	1 acre	½ acre			
Rye (feed)	Contributory	9 acres	9 acres	9 acres	5 acres	11 acres		
Clover	Contributory					11½ acres		
Improvement projects		Planted shade trees	Planted shade trees	Kept farm accounts Tested and improved dairy herd	Kept farm accounts Tested and improved dairy herd	Kept farm accounts Tested and improved dairy herd Set out shrubs		
Supplementary farm practices		Operated manure spreader Treated seed potatoes	Treated seed wheat Adjusted cream separator	Tested seed corn	Caponized cockerels			

Fig 15 This program of a student of vocational agriculture in the North Central area lacks the necessary grain crops to balance with the livestock produced, however it amply provides needed forage with sufficient legumes to maintain soil fertility (*Vocational Division Bulletin 225, U.S. Office of Education*)

"GROWING" INTO LIVESTOCK RAISING

Production project	Classification	In day school				Out of school		
		1st year	2d year	3d year	*4th year*	1st year	2d year	3d year
Range beef	Major	64 head	111 head	141 head				
Sheep	Major	50 head	76 head	86 head				
Goats	Minor	35 head	50 head	71 head				
Horses	Minor	12 head	14 head	9 head				
Sows	Minor	3 head	3 head	3 head				
Fat swine	Minor		90 head	12 head				
Corn	Contributory		50 acres	175 acres				
Sudan grass	Contributory	40 acres	40 acres					
Oats	Contributory		40 acres	40 acres				
Cane	Contributory			18 acres				
Improvement projects		*Landscaped town* home	*Landscaped ranch* home					
Supplementary farm practices			Made rope machine Pruned trees Computed poultry rations	Tanned hides				

FIG 16 This program of a student of vocational agriculture in the southern range and dry land plains farming area shows an unusual development of a well balanced livestock and accompanying feed-crop program by the time he became a senior in high school The scope in livestock and acreage, though large is quite typical for this section Improvement projects and supplementary farm practices show lack of attention (*Vocational Division Bulletin 225, U S Office of Education*)

GROWING INTO LIVESTOCK RAISING

Production projects	Classification	In day school: 1st year	In day school: 2d year	In day school: 3d year	In day school: 4th year	Out of school: 1st year	Out of school: 2d year	Out of school: 3d year
Sheep	Major		15 head	11 head	70 head	70 head		
Sugar beets	Major	2 acres	3 acres	3 acres	4 acres	10 acres		
Beans	Major	5 acres	5 acres	23 acres	20 acres	20 acres		
Beef	Minor		2 head	3 head	1 head	1 head		
Wheat	Minor				5 acres	10 acres		
Alfalfa	Contributory	5 acres	5 acres	10 acres	15 acres	20 acres		
Pasture	Contributory				15 acres	15 acres		
Improvement projects		Killed noxious weeds Landscaped home grounds Repaired all machinery	Contoured land Leveled land Planted shrubs Painted barn	Killed noxious weeds Planted trees Built corral Built new fence	Killed noxious weeds Cut willows along ditch banks	Plowed under sweet clover as green manure Planted shrubs		
Supplementary farm practices		Butchered beef and hogs Culled poultry Castrated calves	Caponized cockerels Castrated pigs	Repaired a harness Vaccinated pigs Treated oats for smut	Prepared fair exhibits Butchered and cut up a hog	Tested milk Soldered leaky pails		

FIG 17 This program of a student of vocational agriculture in the Intermountain irrigated area shows crops and livestock well suited to the section (*Vocational Division Bulletin 225, U S Office of Education*)

"GROWING" INTO LIVESTOCK RAISING

Production project	Classification	In day school: 1st year	In day school: 2d year	In day school: 3d year	In day school: 4th year	Out of school: 1st year	Out of school: 2d year	Out of school: 3d year
Registered sows and litters	Major		2 litters	12 litters	23 litters	21 litters		
Registered beef	Major		1 head	2 head	6 head	12 head		
Baby chicks	Minor			200 head	200 head	200 head		
Sheep	Minor				4 head	7 head		
Laying hens ½ ownership	Minor				310 birds	300 birds		
Potatoes	Minor				½ acre	1 acre		
Corn	Contributory		8 acres	16 acres	24 acres	32 acres		
Barley	Contributory			24 acres	30 acres	40 acres		
Sorgo	Contributory				3 acres	8 acres		
Soybeans	Contributory				3 acres			
Oats	Contributory					*12 acres*		
Improvement projects			Built fences Remodeled farm shop Planted 25 shade trees	Made blueprints and rearranged fields on 160 acres Remodeled farm buildings *Painted 2 barns* Planted 20 shade trees	Seeded pasture *Built calf yard* Wired barn for electricity Installed corral water line Contoured 40 acres	Contoured 30 acres Planted an orchard Rebuilt a large hog barn Reconditioned farm machinery Rebuilt corrals		
Supplementary farm practices			Refitted small tools Built workbench	Tested milk	Rabbit screened trees	Pruned trees		

FIG 18 This program of a student of vocational agriculture in the corn hog section won national recognition on several occasions Steady progression in scope and number of livestock *enterprises is noted* Later the number of cattle was doubled, the farming acreage materially increased, and a breeding swine reduction sale to balance his farming program netted the individual over $3,500 (*Vocational Division Bulletin 225, U S Office of Education*)

The efficient use of reliable agricultural forecasts, estimates, and outlook material is again emphasized The livestock raiser must be a student as long as he continues in the livestock business.

If an enterprise has been started on a small scale and from time to time additional females are added by purchase, the greatest care should be exercised in their selection and an effort made to improve the quality of the herd as well as increase the numbers. The greatest of care should always be used in the purchase of sires to make sure that their progeny will contribute improved rather than undesirable qualities.

Next in importance to watching the breeding of the herd is close attention to the feeding plan that is followed. There have been many

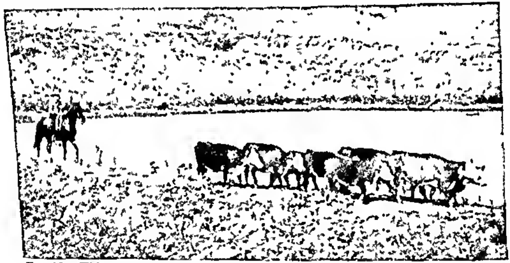


FIG 19 This young man became established in ranching through foundation animals and other assets secured while studying vocational agriculture He was named Star Farmer of America in the F F A organization (*R Turnbull, Kansas City Star.*)

progressive developments in the field of animal feeding during the last 25 years. During this period, the use of mineral supplements, vitamin supplements, and proteins of the correct composition or quality has created an opportunity to secure faster gains, larger production, and more efficient use of feeds. It is to be expected that new information necessitating further changes in management plans and operating procedure will appear in the future. The progressive stockman must accept these new practices and procedures as soon as they have been proved to be beneficial to his enterprise. Otherwise, he will fail to take full advantage of new opportunities to increase profits.

A careful study of Figs 13 to 18 will reveal certain changes, adjustments, and additions that were made by boys and young men while

"growing" into the business of raising livestock. Attention is called to the development of these individual programs where the number of head of certain kinds of livestock was either increased or decreased; where livestock enterprises were added or dropped; where acreages of feed crops were adjusted; where purebred replacements were made; and where there were similar shifts in plans. It will be noted that each program shows steady and continuous growth. Intelligent changes were made largely on the basis of past experience, forecasts, up-to-date information on market and feed situations, and the availability of funds with which to continue. These examples indicate the safest and most satisfactory way for the young man interested in livestock raising to proceed.

6. Making a Success of Livestock Raising

As already indicated, livestock raising is an interesting and profitable undertaking for many people. However, in order to succeed, the livestock raiser must develop his abilities in various ways. In general, he must be able to do the things that result in efficient production along the lines for which his animals are kept. He must then be able to market his animals or their products to the best advantage. Thus, the hog raiser must be able to do the things that result in producing hogs at a reasonable cost per pound, and he must know how and when to market them to advantage. The dairyman must know how to produce butterfat or milk at low cost and how to sell the product at a favorable price. Among the necessary jobs the stockman must be able to do well are the following:

1. Select the livestock enterprises wisely, as discussed in this chapter.
2. Select farm animals that have possibilities for efficient production.
3. Feed farm animals efficiently.
4. Provide proper housing and equipment.
5. Care for animals and their products properly.
6. Protect and maintain the health of animals.
7. Improve animals through breeding.
8. Keep and use necessary records.
9. Market farm animals and their products to advantage.
10. Prepare and process livestock products for home use.

To attain a high degree of success in livestock raising, it is important that the stockman possess the ability to meet all these requirements. For example, he may select good animals and do everything necessary except protect them from diseases and parasites. This one

neglect could easily result in complete failure of the entire livestock enterprise If he lacks the ability to meet any of the other requirements, his chances of success are reduced Thus it is seen that the development of the necessary abilities is the key to success in livestock raising Improving oneself along these lines is a challenge that should call forth the best efforts of any person who chooses to engage in livestock raising

SUPPLEMENTARY ACTIVITIES

1 Visit several successful livestock farms or ranches on which different kinds of animals comprise the major livestock enterprises From your own observations and by talking with the owner or operator, determine the principal characteristics of the farm and abilities of the operator that appear to have contributed most to his success Note characteristics of the farm that may be a handicap to still greater success and shortcomings in the plans followed that might indicate weaknesses on the part of the operator in some of the essential abilities

2 Study your own home farm from the viewpoint of the kind of live stock enterprises to which it seems best adapted according to factors presented in Chap 1 If it seems that some livestock enterprise other than those enterprises being followed, offers a larger opportunity for profit, discuss possibilities and problems that would be met in making a change

3 Secure and study materials from the U S Department of Agriculture and the College of Agriculture of your state relative to the "outlook" for each kind of livestock For each kind of livestock, study what seems to be its position in the price cycle What conclusions should you draw as to the advisability of starting in each livestock enterprise at this time? What conclusion should you make as to whether to reduce or expand each enterprise on a farm or ranch where it is established?

4 With your father and your agriculture teacher decide on the kind or kinds of livestock you can raise as your own or in partnership with your father In making this choice, consider various factors mentioned on preceding pages In case a partnership arrangement is to be developed between you and your father, agree upon the part each is to furnish and the share of each in the income or returns As you study livestock production during the year, make plans for securing and raising foundation animals, utilizing suggestions from various portions of this book

5 Analyze some of the livestock enterprises on your home farm or ranch, and with your father decide on which ones might be improved through the joint efforts of you and your father During the coming year, make definite plans for improvement and assist your father in carrying them out

2. Selecting Livestock

After definitely deciding to raise a certain kind of livestock, as discussed in Chap. 1, securing animals which have possibilities of producing efficiently in line with the purpose for which they are kept becomes the problem. Useful products obtained from farm animals include meat, hides, milk, butterfat, wool, and energy to do work. The beginner must learn how to select animals that are suited for the type of production that he has in mind. As a first step, he frequently raises the question, "What breed shall I keep?" Following this, he is concerned with the problem, "How do I select individual animals within a breed which will be suitable for the purpose for which I wish to keep them?"

In the pages that follow, attention is given to (1) how to choose breeds and (2) how to select individual animals. Information is also included on selecting breeds and animals for each kind of livestock, namely, hogs, dairy cattle, beef cattle, dual-purpose cattle, sheep, horses, goats, and mules. This information is presented under the following activities:

1. Choosing Breeds of Farm Animals
2. Selecting Individual Animals
3. Selecting Hogs
4. Selecting Dairy Cattle
5. Selecting Beef Cattle
6. Selecting Dual-purpose Cattle
7. Selecting Sheep
8. Selecting Goats
9. Selecting Horses
10. Selecting Mules

1. Choosing Breeds of Farm Animals

Before considering the question of what breed to select, decide on the purpose for which the animals are to be raised. If you wish to raise cattle to market as beef, study the beef type of cattle, as these are

best suited for this purpose. If you wish to produce milk and butterfat the dairy type of cattle is logically the group upon which to focus attention. Similarly, choose either the lard or the bacon type of hogs, the mutton or fine wool type of sheep, and the draft or one of the

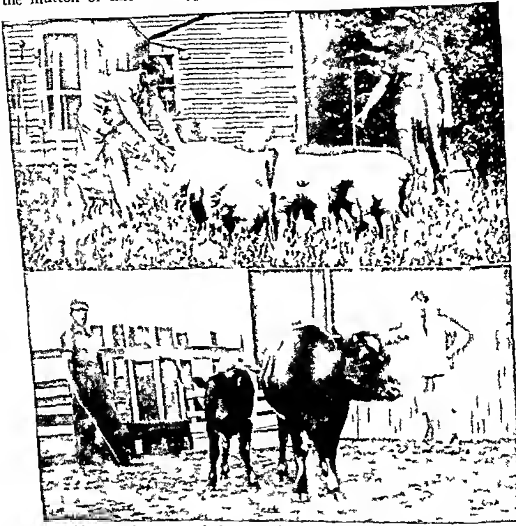


Fig. 20. Foundation animals for livestock enterprises. This young man of Olivet, Mich., secured these animals while a student of vocational agriculture. Shown with him is his teacher of vocational agriculture. A father-son partnership has since developed on this farm.

various lightweight types of horses depending on the primary purpose in mind. Each of these types of farm animals has characteristics that make it highly useful for a specific purpose or purposes. However, as discussed later, individual animals in each group frequently differ widely as to their degree of usefulness.

In general, it can be said that the various types of farm animals have been developed nearest to perfection in purebreds. This does not imply that all persons raising livestock will wish to raise purebreds. However, common herds and flocks have been improved by using purebred sires of a breed falling within the type desired. For example, the alert producer of beef cattle selects purebred sires from one of the breeds of the beef type, although the female animals he owns may be grades Even in selecting grade females, some consideration will usually be given to their breed characteristics in terms of the breed that they typify. Thus, familiarity with breed characteristics is a definite asset to a live-

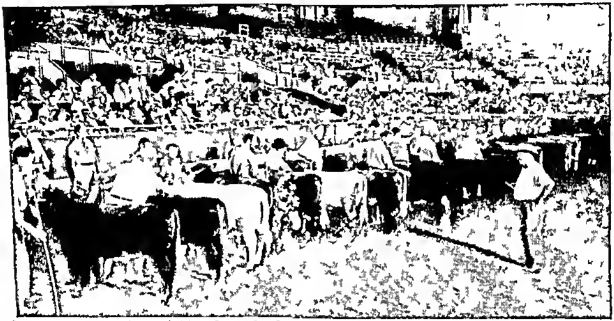


FIG 21 This class of Shorthorn heifers at one of the leading shows represents near perfection in type and form Final selection of top quality breeding stock requires consideration of several additional factors (*The Shorthorn World, photograph by J C Allen and Son*)

stock producer, although it should be recognized that there are greater differences in producing ability between animals within a given breed than between the average animals of the various breeds of a given type

"What is the best breed of hogs?" "What is the best breed of dairy cattle?" These are familiar questions, and too often a person undertakes the selection of a breed with the notion that he will somehow discover the one best breed. After you decide on the type of livestock, the choice of breed of livestock will depend on several factors; these are discussed in the paragraphs that follow.

Prevailing Breeds in the Community. In selecting a breed of livestock, note which breeds *prevail in the community. As a new breeder* you are not likely to go wrong if you select one of these, for they have

Pedigrees Pedigrees are usually available from breed registry associations for purebred animals that are for sale These are usually obtained by the seller, who also arranges with the breed association for transfers of pedigrees to the purchaser A pedigree is a record of the names and registration numbers of the ancestors of a given animal and generally includes the parents grandparents, and one or more generations beyond this The main value of a pedigree of the usual kind is that it provides evidence that the animal under consideration is a purebred As you become familiar with the names of outstanding animals in a breed, look for them in a pedigree In doing so, guard against putting too much emphasis on an outstanding ancestor, two or more generations back that really has little influence on the animal under consideration A pedigree at best provides little assurance that the animal represented will measure up to its ancestors in performance or offspring produced

Performance By performance in farm animals is meant their ability to produce, or "perform," in accordance with the purpose for which they are kept For dairy cattle, performance of each cow is measured in terms of milk and butterfat produced by her in a given period of time For swine, the performance of one animal may be measured in terms of rate of gain and the performance of a litter by their combined weight at a given age, such as 56 days or 180 days Performance for beef is measured by rate of gain and market grade Performance for sheep includes the items indicated for beef cattle and in addition the quantity and quality of wool produced For draft horses, performance is measured by the load pulled and endurance, or the ability to work continuously over a period of time More attention is given to these measures later in this chapter and in Chap 7

Prepotency The only assurance that an animal will transmit desired characteristics to its offspring lies in securing evidences of its prepotency, that is, its ability to transmit desired characteristics to its offspring This can be determined best from its offspring, although some other approaches are also helpful in this regard These will be discussed in connection with each kind of livestock

The selection of desirable breeding animals is not a simple matte if you are interested in securing individuals that are good producer and which transmit desired characteristics to their offspring Som of the important considerations in selecting each kind of livestock ar discussed in the pages that follow In Chap 7, further emphasis

placed on certain phases of selection related to breeding and improving herds and flocks.

In selecting farm animals, consider certain factors in addition to those already mentioned; among them are reproductive ability, health, age, time of breeding, sire used (in purchasing a bred female), and price. Some attention is given to these factors in the discussion for each kind of livestock.

3. Selecting Hogs

Choosing Breeds. There are eight common breeds of hogs in the United States. These include six breeds of the lard type and two of the bacon type. The lard-type breeds have a greater tendency to put on fat than those of the bacon type. This is shown by wider, deeper bodies in the live animals ready for market and by a higher proportion of fat to lean in the dressed carcass. Most of the hogs produced in the United States are of the lard type. It should be understood that besides the fat from which lard is made, considerable meat for bacon and other purposes is obtained from the lard-type animals when they are slaughtered. In fact, the lard type of the present day is frequently called the "meat type" of hog. Likewise, portions of the carcasses of the bacon-type hogs are useful for meat purposes, and other portions are used for lard.

The six breeds of the lard type found most commonly are Duroc, Poland China, Spotted Poland China, Chester White, Hampshire, and Berkshire. The chief difference between the first four breeds is in color, although enthusiasts for any one of the breeds may claim various points in its favor. The Duroc is solid red in color, preferably cherry red. The Poland China is black except for small amounts of white, usually restricted to the feet, nose, and end of the tail; these markings are often referred to as the "six white points." The spotted Poland China, as the name implies, has a spotted appearance, the black interspersed with white spots over most or all of the body. The Chester White is solid white in color. Animals in all four of these breeds have drooping ears; the faces are medium in length and slightly dished.

The Hampshire and Berkshire have erect ears. The face of the Hampshire is quite long and nearly straight and the nose is somewhat pointed, while the typical Berkshire has a short, upturned nose, which makes the face quite dished in appearance. The Hampshire is black with a white belt around the body in the region of the shoulders and

usually demonstrated their suitability for the conditions and markets of the community Also it will be easier for you to purchase breeding stock and to dispose of surplus animals if the breed is well represented in your community

Personal Preference. Another factor in breed selection is personal preference Usually a person starting with purebred livestock on a farm where purebreds are already raised will have developed a preference for these breeds Too often however, a person just takes a liking to a certain breed his feelings toward it being based entirely on whim or fancy In such a case it may be more desirable to select some other breed in terms of the factor previously discussed

Other Considerations in Choosing Breeds. Many claims of superiority for certain breeds may be the outgrowth of unwarranted enthusiasm on the part of breeders and breed associations A young livestock man should recognize this fact and consider critically the printed materials or sales talks by breeders which present in glowing terms the merits of a breed

In raising livestock keep in mind that there is no best breed for all conditions as borne out by evidence from many sources For example the U S Bureau of Dairy Industry has tabulated data on the yearly production of thousands of individual dairy cows of different breeds as secured through Dairy Herd Improvement Associations (D H I A) These figures indicate that there are far greater differences in production between animals *within each breed* than in the averages *between breeds* If we pause to consider the matter, we realize that if there were a best breed of dairy cattle for all conditions or a best breed of any kind of livestock this fact would have been discovered long before now and most ranchers and farmers would be raising it to the exclusion of other breeds

Some may tend to take too seriously the matter of breed selection At the same time they may give too little attention to the important things to consider in the selection of individual animals used for foundation stock or for building up a herd already started

2 Selecting Individual Animals

Regardless of the breed chosen in starting in livestock production give careful consideration to the selection of individual animals within that breed Animals within a breed differ greatly with respect to their ability to produce along the desired lines Furthermore they differ

widely in their "prepotency," that is, in their ability to transmit the desired qualities or characteristics to their offspring.

In selecting individual animals for breeding stock, give careful attention to the several factors associated with the purpose for which the animals are raised. These factors include (1) appearance or type, (2) pedigree, (3) performance, and (4) prepotency.

Appearance or Type. Selecting animals on the basis of type or outward appearance, frequently referred to as "judging," is the most common method in use. By this means, it is possible to decide whether or not an animal is pleasing to the eye and whether its type conforms

FIG 22 These youths are selecting gilts for breeding purposes from pens in which litter mates are placed together Type and uniformity within the litter are considered, as well as the number of pigs raised in each litter, and the weight of the litter at 56 days

in a general way to the purpose for which it is intended This method is also of value in noting characteristics that are approved for a particular breed. However, a person planning to engage in livestock production frequently gets the idea that if he becomes an expert judge he can decide from outward appearance which dairy cows are high producers, or which hogs gain most rapidly, or which horses can pull the heaviest loads. This is far from true, as these qualities can be determined with sufficient accuracy to be of value in selection only by performance records, as discussed later in this chapter. Furthermore, outward appearance alone does not indicate accurately the quality of offspring that will be produced.

may have white markings on the legs and the end of the tail The Berkshire has a black body and head with white on the nose, legs and tail The Berkshire and Hampshire are somewhat intermediate in type between the strictly lard breeds and the strictly bacon breeds, but they are definitely classed as lard breeds

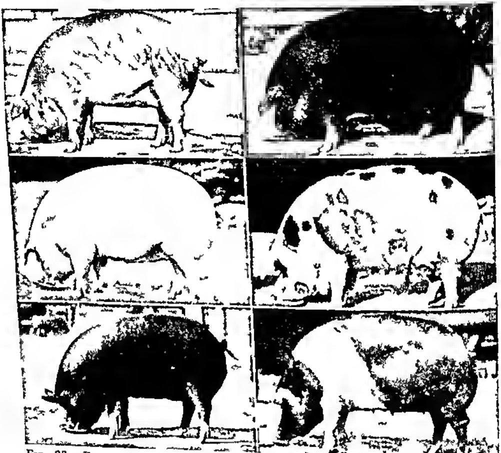


Fig 23 Representative sows of six common breeds of lard type hogs *top left* Duroc *top right* Poland China *middle left* Chester White *middle right* Spotted Poland China *bottom left* Berkshire *bottom right* Hampshire (*Photographs by Smith*)

Hogs of the strictly bacon type are not commonly found in the United States The two breeds most frequently represented are the Tamworth and Yorkshire The Tamworth is red and the Yorkshire is white Each breed can be differentiated from the lard breed to which it is similar in color by the narrow body and erect ears The Yorkshire has a medium length face with considerable dish while the Tamworth has a fairly long narrow straight face

The Duroc, Poland China, Spotted Poland China, and Chester White breeds originated in the United States, although their ancestors were imported. Most other important breeds of livestock originated in foreign countries and were afterward introduced into the United States, as will be noted in the discussions of breeds at later points in this chapter The

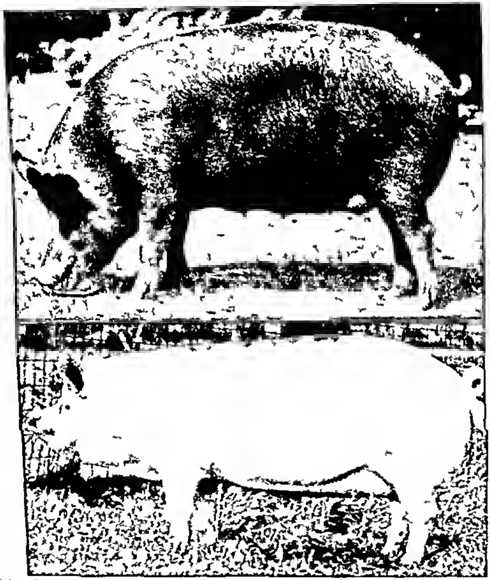


Fig 24 Representative sows of two breeds of bacon type hogs *upper*, Tamworth *lower*, Yorkshire (*Upper photograph by Smith, lower by Canadian Yorkshire Breeders Association*)

Duroc originated from a combination of two types of red hogs that existed in New York and New Jersey from 1800 to 1850, one known as the "Duroc" and the other as the "Jersey Red" The Poland China was formed from several strains of stock; the breed originated in the Miami Valley of Ohio The Spotted Poland China is a comparatively new breed, which descended chiefly from animals within the Poland

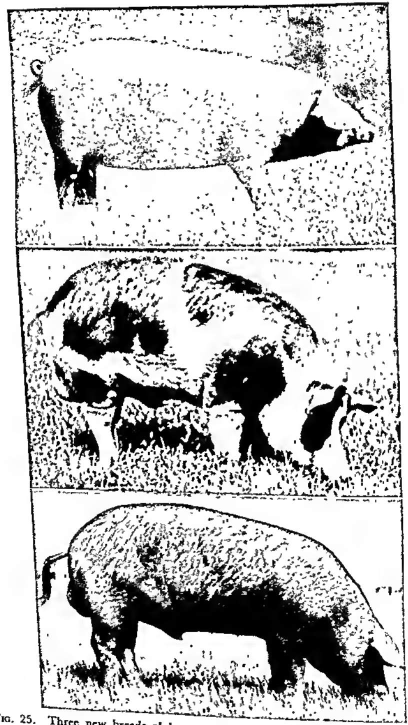


FIG. 25. Three new breeds of hogs: *top,* Minnesota No. 1 gilt; *center,* Minnesota No. 2 boar; *bottom,* Montana No. 1 boar. (*Inbred Livestock Registry Association.*)

China breed in the state of Indiana. The Chester White originated in southeastern Pennsylvania in the region of Chester County during the period of about 1820 to 1860. It is believed that the Hampshire originated in the county of that name in England. The home of the Berkshire and Yorkshire is England, and they bear the names of counties in that country. The Tamworth also was developed in England and is named after the town of Tamworth in Staffordshire.

The Hereford is a recent breed of hogs of the lard type. This breed originated in the United States, with animals from several breeds used in the early stages of development. Its color markings are similar to those of cattle of the Hereford breed, hence the name.

Several breeds of swine similar to the bacon type have recently been developed in the United States. To date, these include Minnesota No. 1, Minnesota No. 2, Montana No. 1, Maryland No. 1, and Beltsville No. 1. These breeds were developed through crosses between breeds, followed by inbreeding and rigid selection based on performance and body conformation. In producing the Minnesota No. 1, Montana No. 1, Maryland No. 1, and Beltsville No. 1, individuals of the Danish-Landrace breed were used in each case in crosses with individuals from some other breed. These latter breeds were, respectively, Tamworth, Hampshire, Poland China, and Berkshire. In producing the Minnesota No. 2, a Yorkshire boar was crossed with Poland China sows. These new breeds are used to some extent in crossbreeding with the lard breeds to produce market hogs. Three of these new breeds are shown in Fig. 25.

Selecting a Gilt or Sow. In selecting a gilt or a sow, the primary aim is to secure a female that will produce large litters of fast-growing pigs capable of being fattened to marketable weights of around 225 lb. at an age of six months or less. Further information on rate of gains and other measures of efficiency in swine production is given in later paragraphs of this chapter and in Chap. 7.

Appearance or Type. Before selecting a gilt or sow by its appearance or type, have a clear mental picture of the desirable type. This ideal of type can be developed by inspecting animals that place high in shows, by studying pictures of such animals, and by securing training in selecting animals under the direction of a good teacher. In studying the individual animal, know the correct name of each part as shown in Fig. 26.

Experiments at the Illinois Experiment Station and elsewhere indicate

that hogs of the so-called "medium," or intermediate," type are more desirable than either the small chuffy type or the long, rangy type This intermediate type gains more rapidly and economically Compared with the large type, the intermediate type produces a better quality of carcass and can be finished for market at a younger age

In selecting a gilt or sow on the basis of appearances, consider the following main points (1) general form or type, (2) size or weight for age (3) development in the regions of high priced cuts of pork, (4) quality, (5) feet and legs

In general form or type, a desirable gilt or sow presents a well balanced appearance From the side view, the topline appears as a strong, uniform arch, the underline is straight, the legs are medium in length, the sides are deep and long As viewed from the front or rear, the shoulders, back loin, and rump are fairly wide and the width is carried uniformly from front to rear Gilts do not show as much depth of body as sows and consequently appear more leggy at the younger age A desirable animal has a large heart girth as indicated by the distance around the body just behind the shoulders The head is trim in appearance, with good width at the snout and between the eyes The face is medium in length, varying somewhat with the breed The various characteristics of the head and ears and the color should conform to those desired for the particular breed to which the animal belongs

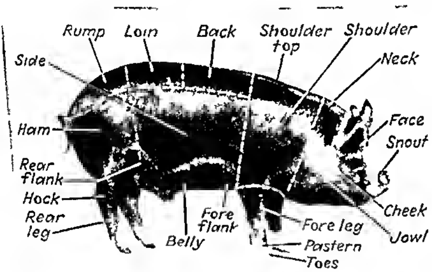


FIG 26 Names and locations of parts of a hog

In size or weight for age, a good gilt or sow in average condition is large for her age; such animals are usually the most economical to raise. The pig at weaning age of about 56 days should weigh at least 30 lb. The best ones reach 50 lb. or more. A six-month-old gilt in good condition should weigh upward of 200 lb., and an eight-month-old gilt should weigh 260 lb. or more. In selecting hogs, develop the ability to estimate weights fairly accurately without the use of scales. Learn to do this by checking estimates with actual weights, until your judgment is trained.

A good gilt or sow shows a reasonable amount of development in the regions of the high-priced cuts of pork. The high-priced cuts are (1)

FIG 27. A barrow of a lard type breed showing the desired intermediate or medium characteristics

pork chops, which come from the back and loin; (2) ham, which comes from the rear quarters; and (3) bacon, which comes from the sides Therefore, select animals that have wide, full hams, as shown by the side and rear views. Give preference to a body that is wide over the back and loin and long and deep, as previously discussed. Do not expect gilts to show development in these regions equal to that of mature sows. Bacon-type hogs are considerably narrower in body than those of the lard type.

Quality, or refinement, to a reasonable degree is desirable. This is indicated by fineness of hair and bone. Select a gilt or sow with a bone structure that is medium in size. Judge the size of bone from the size of the leg below the knee or hock. The sides of a desirable hog are free

from creases or wrinkles, and the shoulders are trim and free from excessive width or coarseness, as noted especially from a top view in the shoulder region

Inspect carefully the feet and legs of a gilt or sow, as weaknesses in these regions handicap the breeding animal See that the legs are straight when viewed from the sides, front, and rear The pasterns should be short and upright The toes on each foot should be well formed and close together

Inspect the teats of a gilt or sow to note whether they are all properly formed, with no "blind," or inverted, teats present Such defective teats are undesirable, as they do not produce milk following farrowing Consequently, the number of pigs raised is reduced, since small pigs "fight it out" until one pig per nipple survives Select a gilt or sow that has at least 10 and preferably 12 or more properly formed teats

Pedigree A pedigree is a record of an animal's ancestors The pedigree of a hog usually includes the date of birth, number of pigs farrowed in the litter of which it was a member, number of pigs of each sex raised, and the address of the breeder The name and registration number of the pig are given, as well as similar information for the sire and dam and the ancestors for two or more generations back In considering the pedigree, know something about the characteristics of the individual animals in the pedigree, such as their type and show-ring records Also consider any data on weights of litters at 56 days, if available, and whether any sows or boars appearing on the pedigree have qualified for the Production Registry or Register of Merit of that breed The latter types of information are especially important and are discussed further in the following paragraphs

Performance, or Productive Ability While appearance and pedigree are important, it is even more desirable to consider actual performance, or productive ability, of an animal In the case of a gilt or sow, one measure of efficiency is its rate of gain as shown by its weight for its age, previously discussed In the case of a sow, secure information, if possible, on the number of pigs in each litter that she has farrowed, number of pigs raised per litter, and the weight of the litter at 56 days or a later age Probably, the best single measure of the ability of a sow to produce is the weight of her litter at 56 days, the usual weaning time A superior performance for a sow is to raise eight or more pigs to a litter weight of 325 lb or more at 56 days Seven or more pigs weighing around 300 lb is a superior performance for a gilt with her first litter

Prepotency, or Transmitting Ability. Since gilts are purchased before they have pigs, it is not possible to determine their prepotency, or transmitting ability, as can be done with a sow. For a sow that has produced a litter, note the number of pigs farrowed and raised and the total weight of the litter at 56 days. Also, in inspecting the offspring, observe the tendency toward uniformity or lack of uniformity among the pigs in the litter. A sow that has raised one or more litters is called a "tried" sow. Information for two or more litters from a sow is a more accurate test of her prepotency than for one litter only.

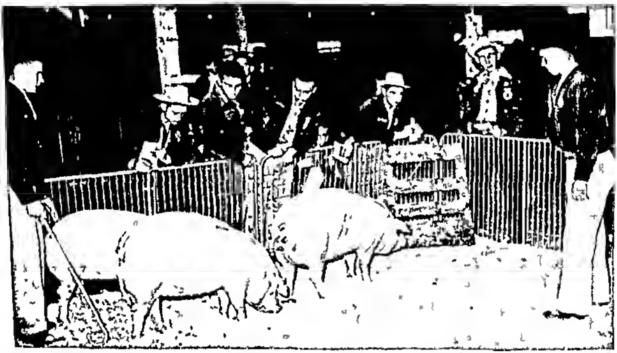


FIG 28 Placing a class of gilts at the National Vocational Livestock Judging Contest on the basis of type, together with performance records of the litters from which the animals came.

As emphasized further in Chap. 7, note the weight of the litter of which the sow or gilt under consideration was a member. Some experiments have shown that females coming from litters of high weights at 56 days are more likely to produce heavy-weighing litters than females from lower weighing litters.[1] The standards for weight of litters and number of pigs raised as indicated under performance will usually be acceptable. In addition to the immediate litter, consider, if available, the weights of litters of which close-up ancestors were members.

Since the number of pigs in a litter is in part determined by inheritance, the gilt or sow should come from a fairly large litter, preferably 10

[1] Some Factors Influencing Efficient Production of Sows, Agricultural Experiment Station, *Bulletin* 461, Columbus, Mo., 1943.

to 14 pigs Close-up ancestors should also come from large litters Sisters and half sisters, if data are available, should also show prolific tendencies, as indicated by the number of pigs in the litters they produced

Inspect the litter mates of a sow or gilt, if available If they tend to be uniformly good, this is an indication of uniform inheritance Similarly, if possible, look over the sire and dam of the animal under consideration to note if there is a marked tendency for good qualities to be transmitted from parents to offspring

Of course, it may not be possible to get all the information indicated in the preceding However, alert breeders are giving more and more attention to keeping records that provide this type of information, as discussed in Chap 8 This information is of value to them in their breeding operations and in providing information to prospective buyers (see Chap 7)

Additional Factors in Selecting a Gilt or Sow It goes without saying that, in selecting a gilt or sow, one should consider evidences of thriftiness and good health It is desirable to secure an animal from a herd with a history of good health and usually in which all animals were immunized against hog cholera

Give some consideration to the age of the gilt that is purchased In general, it is best to secure one that is at least three or four, preferably six, months old Younger animals may appear satisfactory at the time of selection but sometimes develop imperfections in type as they grow larger Sows, if they can be purchased at a reasonable price, have the advantage of having proved themselves through one or more previous litters Furthermore, they will usually farrow and raise more pigs, and the pigs will be heavier at weaning time However, the young breeder commonly makes his start with a gilt because of the lower investment required at the outset

In purchasing a bred sow or gilt, consider the boar to which she is bred and the date she is due to farrow Frequently, beginners in raising livestock prefer to buy bred sows or gilts, especially if they are bred to a superior boar Note the date a sow or gilt is due to farrow to determine whether or not it is satisfactory for the conditions under which the pigs are to be raised Usually, a gilt or sow can be considered to be in pig if she has passed one heat period, although it is desirable to have some understanding with the breeder as to what guarantee he is willing to assume

In considering the purchase of a gilt or sow, the price to be paid

should be in line with the various qualities and characteristics discussed on the previous pages. Persons just getting started will wish neither to pay an extremely high price nor to sacrifice desired qualities by being penny-wise and pound-foolish. A few extra dollars paid for a sow or gilt of superior merit will usually be money well spent when it is considered that the price will be prorated over several pigs in the first litter or over several litters if the sow is retained longer.

Selecting a Boar. In selecting a boar, take into account most of the considerations mentioned for selecting a gilt. In type, secure a boar that answers the general description given for a desirable type of gilt or sow. A desirable boar is larger for his age and heavier of bone than a gilt, and he shows masculinity and ruggedness, rather than femininity. Secure a purebred that comes from a litter of pigs uniformly good in type and fast-growing, as shown by the weight per pig and the total weight of the litter at 56 days or a later age. A higher weight for this litter is more often demanded than in selecting sows or gilts. For example, some breeders consider only boars that come from litters of eight or more pigs raised, with a litter weight of 400 lb., or more, at 56 days. The number in the litter is important because the tendency to produce large litters is transmitted, and the boar as well as the sow has an influence on the prolificacy of its offspring. However, the boar normally has little or no influence on the number of pigs in the litters that he sires.

If possible, purchase a boar that is himself a son of a Registry-of-merit or Production-registry sow for the breed and sired by a boar that has proved himself to be prepotent by siring litters of desired type and ability to gain. Additional information along this line will be found in Chap. 7.

As with a gilt, a boar should be four to six months of age at the time of selection, since serious defects in type are not so likely to develop after this age is reached.

Selecting Feeder Pigs. Secure feeder pigs that are healthy, vigorous, and thrifty and give promise of being rapid growers. Thus, size or weight in accordance with age is important if the age is available. Pigs are commonly bought as feeders at any age from eight weeks (or weanlings) to several months of age. Feeder pigs on the market commonly range from 50 to 150 lb.

Quality in feeder pigs is desirable, as indicated by smooth, compact shoulders and freedom from coarseness throughout the body.

Buy feeder pigs at a price such that gains can be put on with a

reasonable chance for profit. In this connection, consider the corn-hog ratio as a basis for estimating possible profits (see Chap. 9). Furthermore, as a prospective purchaser of feeder pigs, estimate the various items of expense, including the purchase price and feed. Then, estimate the probable selling price, as discussed in connection with budgeting in Chap. 8. Table 5 in Chap. 3, showing feed requirements, is helpful in estimating amounts of feed that will be needed in feeding the pigs to desired market weights

Where several feeder pigs are purchased, select pigs that are fairly uniform in age, weight, type, and condition so that they will make the best gains while being fed together Such pigs also make a uniform group when marketed If possible, buy feeder pigs from herds that produce fast-gaining stock.

4. Selecting Dairy Cattle

Choosing Breeds. As mentioned at the opening of this chapter, several factors may influence the choice of a breed. In selecting a breed of dairy cattle, the type of market for products is likely to be an important consideration. When milk is to be sold to manufacturers of cheese or condensed milk, breeds that test 4 per cent butterfat or less are preferable. For producing butter or cream, the breeds are practically equal although Jerseys and Guernseys, in general, produce 1 lb. of butterfat at a slightly lower cost than the lower testing breeds.[2] This is offset by the larger amounts of skim milk from the lower testing breeds, which can often be used to advantage in feeding pigs, calves. and poultry. Special markets for fluid milk ordinarily pay for milk on the basis of butterfat content, and the prices are usually such that all breeds can be used for this purpose

For each of the five most common breeds of dairy cattle, the following data provide information on the average butterfat test:

Breed	Average Percentage of Butterfat
Holstein Friesian	3 4
Ayrshire	4 0
Brown Swiss	4 0
Guernsey	5 0
Jersey	5 4

[2] C H Eckles, "Dairy Cattle and Milk Production," pp 106–109, The Macmillan Company, New York, 1939

In general, with the breeds that test lower, the cows average larger amounts of milk than the cows in the higher testing breeds. Keep in mind that individual cows within any breed vary considerably with respect to the test and amount of milk produced. The individual cow produces milk that varies in butterfat percentage from time to time, depending on the stage of the milking period and other factors.

Of the five breeds of dairy cattle previously listed, the Holstein-Friesian (commonly called Holstein), Jersey, and Guernsey are most numerous. In most Northern states, the Holstein is the leading dairy

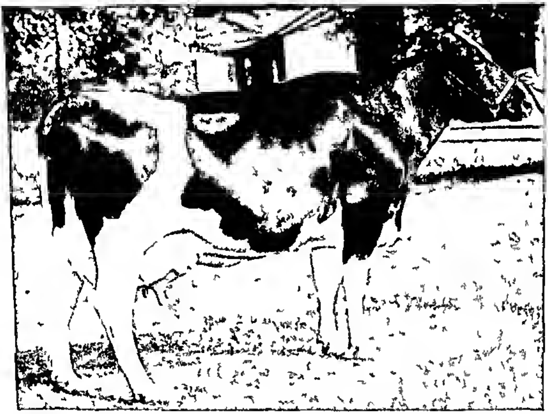


Fig 29 A Holstein Friesian cow (*Photograph by Strohmeyer*)

breed while the Jersey predominates in most Southern states However, individual communities vary considerably in the breed that predominates.

Breeds can be identified by color, size of mature animals, and various other characteristics peculiar to each breed. In color the Holsteins are black and white, with markings sharply defined and with differing proportions of each on individual animals. The Jerseys vary from light fawn to almost black, with spotting of white in some animals. Their muzzles are usually black. The Guernseys are yellowish, brownish, or reddish fawn, with white markings. The Ayrshires are red and white spotted, with varying amounts of each on indi-

vidual animals. The Brown Swiss are brown, varying from a silver gray or mouse color to almost black.

In size, the Brown Swiss and Holsteins are the largest, Ayrshires, Guernseys, and Jerseys ranking below them in the order given.

Various characteristics serve to differentiate the breeds in appearance. The Holstein, being the only black and white breed of dairy cattle commonly found, is quite readily identified. The Ayrshire has horns that curve up and slightly backward as contrasted with the forward-curving inturned horns of the Guernsey and Jersey. The

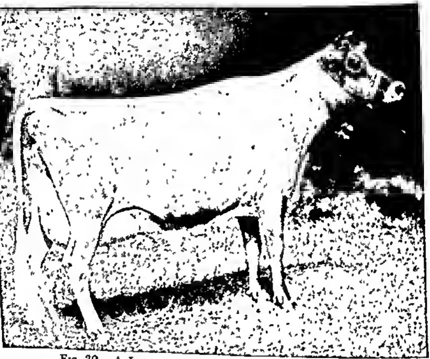


FIG. 30. A Jersey cow. (*Photograph by Strohmeyer.*)

typical Jersey has a head that shows a marked "dish" between the eyes. Both the Ayrshire and the Jersey are noted for their well-formed udders and general body form, which frequently come close to the ideal dairy type.

The native homes of the dairy breeds are as follows: The Holstein-Friesian originated in the Netherlands and derives the last part of the name from a province of that country. The word "Holstein" is the name of a province in Germany; this name was accidentally attached to an early description of the breed, but it is the name that has prevailed. The Jersey and Guernsey came, respectively, from the island

of Jersey and the island of Guernsey, which are neighboring islands in the English Channel. The Ayrshire originated in Scotland and derives its name from the county of Ayr. The Brown Swiss originated in Switzerland.

The Brown Swiss, Holstein, and Ayrshire are said to be more rugged than the other two breeds and capable of consuming larger proportions of roughages. On the other hand, the Jersey is more popular in the Southern states because it seems best able to withstand the heat and humidity.

Selecting a Dairy Heifer or Cow. In selecting a dairy heifer or cow, the primary aim is to secure an animal that will be a profitable

FIG 31. A Guernsey cow (*American Guernsey Cattle Club*)

producer of butterfat and milk over a period of years and transmit to her offspring this capacity to produce In general, for a foundation female, purchase a cow that produces upwards of 400 lb of butterfat per year or a heifer from a cow with at least this level of production. Further information on measures of efficiency for dairy cattle will be found in Chap. 7.

Type of Appearance. In inspecting a diary heifer or cow, it is important to know the names of the parts of the body and to have a mental picture of what constitutes good dairy type. The names of the important parts are shown in Fig. 35.

Outward appearance or type is even less satisfactory as a basis for selecting dairy cows than in selecting meat animals, such as swine and beef cattle In making plans to establish a herd, do not neglect type, but it is more important to secure foundation animals that are first of all good producers However records of production are frequently not available, and the selection must then be based largely on type and other factors In appearance, consider such items as (1) general form or type, (2) dairy character, (3) body capacity, (4) mammary system and (5) size

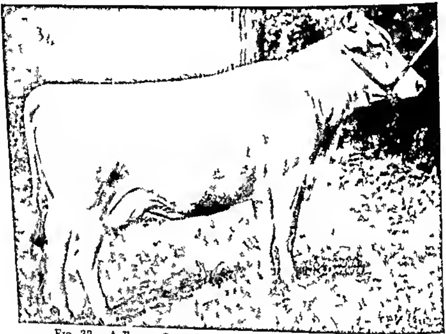


Fig 32 A Brown Swiss cow (*Photograph by Strohmeyer*)

In general form or type a desirable dairy heifer or cow is attractive and well balanced The head is medium in length and clean cut, with a broad muzzle The topline is straight from withers to tail setting The rump is level with good width at the hips and at the pinbones The legs are fairly wide apart and squarely set A dairy heifer or cow preferably shows the desired characteristics of her breed

Dairy character is indicated by (1) freedom from excess fat or beefiness as shown by sharpness at the withers and by thinness of the neck, along the back, and in the thighs, and (2) a soft, loose, and fairly thin skin

Select a cow with a large body capacity, as shown by a deep, long, wide barrel, or middle. The heart girth should be large; this results from a wide chest floor between the front legs, well-sprung foreribs, and a fair amount of depth of body in the region just behind the shoulders.

The mammary system includes the udder, teats, and milk veins. The desirable udder is long, wide, and moderately deep, with all quarters well balanced. The best udder is soft and elastic in texture. It should be well attached to the body, for a large, pendulous udder is more easily injured and is more susceptible to certain udder ailments. See that the teats are well placed and of convenient size and that the milk veins are long, prominent, and branching.

Select a heifer that is large for her age and a mature cow that is large for the breed. Studies show that within a breed the big cows are more likely to be good producers and return a higher income over feed costs than the smaller cows in that breed.[3] At six months of age, well-grown heifers of the larger breeds weigh around 350 lb.; in the lighter breeds, about 260 to 300 lb. At one year of age, satisfactory weights are around 600 lb. or more for the heavier and 460 to 500 lb. for the lighter breeds.[4] Mature cows of the heavier breeds preferably weigh 1,200 lb. or more and the lighter breeds 900 lb. up. Make estimates of weight from heart-girth measurements as shown in Table 2 if no scales are available.

Pedigree. Since a pedigree is merely a record of the ancestors of an animal, unless something is known about the type and production of these ancestors the pedigree is of little value in selecting an animal. In the case of a dairy heifer or cow, secure information about the dam and sire and other ancestors that will indicate something about their type and production. In interpreting a pedigree, the seller may tend to "overplay" the high production of occasional ancestors; these may be so far back that they really had little influence on the animal under consideration.

Record of Performance. In selecting a cow, secure if possible some information about her producing ability. Of course, no such information will be available for a heifer. Usually, high-producing cows

[3] Within the Breed the Big Cows Excel, *U.S. Department of Agriculture, Circular* 114, 1930.

[4] Raising Dairy Calves and Heifers, *Circular* 336, College of Agriculture, Morgantown, W. Va., 1943. See also F. B. Morrison, "Feeds and Feeding," p. 615, The Morrison Publishing Company, Ithaca, N.Y., 1936.

TABLE 2. ESTIMATING THE WEIGHTS OF DAIRY COWS FROM HEART-GIRTH MEASUREMENTS*

By using any accurate tape measure and this table it is possible to estimate with considerable accuracy the weights of individual dairy cows. The measuring tape should be placed around the animal directly behind the front legs. The animal should be standing squarely on all four legs. A cow with a heart-girth measurement of 69 in. should have, according to the following table, an actual weight of approximately 947 lb.; a cow with a heart-girth measurement of 75 in., an actual weight of approximately 1,197 lb.

Heart girth, inches	Weight, pounds	Heart girth, inches	Weight, pounds	Heart girth, inches	Weight, pounds	Heart girth, inches	Weight, pounds
26	80	42½	248	59½	822	76½	1,263
26½	82	43	257	60	837	77	1,285
27	84	43½	266	60½	852	77½	1,308
27½	86	44	275	61	668	78	1,331
28	89	44½	284	61½	884	78½	1,354
28½	92	45	294	82	700	79	1,377
29	95	45½	304	82½	718	79½	1,400
29½	98	46	314	83	732	80	1,423
30	101	46½	324	63½	749	80½	1,446
30½	104	47	334	84	766	81	1,469
31	108	47½	344	64½	783	81½	1,492
31½	113	48	354	85	800	82	1,515
32	118	48½	364	65½	817	82½	1,538
32½	123	49	374	66	835	83	1,561
33	128	49½	384	66½	853	83½	1,584
33½	133	50	394	67	871	84	1,607
34	138	50½	404	87½	889	84½	1,630
34½	143	51	414	68	908	85	1,653
35	148	51½	424	68½	927	85½	1,676
35½	153	52	434	69	947	86	1,899
36	158	52½	445	89½	967	86½	1,722
36½	163	53	456	70	987	87	1,745
37	168	53½	467	70½	1,007	87½	1,768
37½	174	54	478	71	1,027	88	1,791
38	180	54½	489	71½	1,048	88½	1,814
38½	186	55	501	72	1 069	89	1,837
39	192	55½	313	72½	1 090	89½	1,860
39½	200	56	526	73	1,111	90	1,883
40	208	56½	539	73½	1,132	90½	1,906
40½	216	57	552	74	1,153	91	1,929
41	224	57½	585	74½	1,175	91½	1,952
41½	232	58	579	75	1,197	92	1,975
42	240	58½	593	75½	1,219		
		59	607	78	1,241		

* U.S. Department of Agriculture, Bureau of Dairy Industry

are not for sale, although sometimes they can be secured at a price suitable to the buyer. In considering production records, take into account the conditions under which they were made. Cows with a three-times-a-day milking and heavy grain feeding will produce considerably more than they will if milked twice a day and fed normally. In general, a mature dairy cow should produce at least 400 lb. of butterfat on twice-a-day milking in order to be considered a superior

FIG. 33. An Ayrshire cow. (*Photograph by Strohmeyer*)

producer. Ordinarily, if at all possible, in purchasing a heifer secure one whose dam has this production level or higher.

Transmitting Ability. In the case of a cow, some idea of her ability to produce offspring of the desired type can be noted from her daughters or sons. If she has daughters that are of producing age, it is possible also to gain some idea of her ability to transmit high production. If possible, in purchasing a heifer or cow secure one whose sisters and half sisters have been uniformly good producers or one from a "cow family" that has established a reputation for high production. The sire of the heifer or cow should preferably be proved for transmitting high production as shown by comparisons between his daughters and

their dams In Chap 7, additional information is given on determining prepotency or transmitting ability, of dairy cattle

Other Factors in Selecting Dairy Cows The heifer or cow should be vigorous and thrifty and show a clean "bill of health" as far as mastitis tuberculosis and Bang's disease are concerned As a prospective purchaser, you will also wish to consider the age of animal and the time she was bred, if she is in calf The price should be in keeping

FIG 34 Learning to select dairy heifers These students are considering the records of the dams and the pedigrees of the heifers along with type

with the good qualities of the animal under consideration Frequently, young heifers can be purchased with good breeding back of them and from good cow families at a price you can afford to pay, such animals may be most satisfactory for making a start Sometimes, fairly old cows with good lifetime records of production and good offspring can be secured at a reasonable figure

Selecting a Dairy Bull In selecting a dairy bull, the chief aim is to secure a sire that will transmit a desirable level of production and acceptable type to his offspring Someone has said that a bull should

be chosen that will improve the top half of the herd, as far as production is concerned, but this is not easy, especially in high-producing herds.

Type or Appearance. Appearance is likely to prove unsatisfactory as a basis for selecting a dairy bull that is expected to sire high-producing daughters. Although some consideration should be given to the type of bull, it should be recognized that this provides little evidence that he will transmit high production to his offspring.

In inspecting a bull for type, consider general form, dairy character, body capacity, and legs and feet. The desirable bull is well

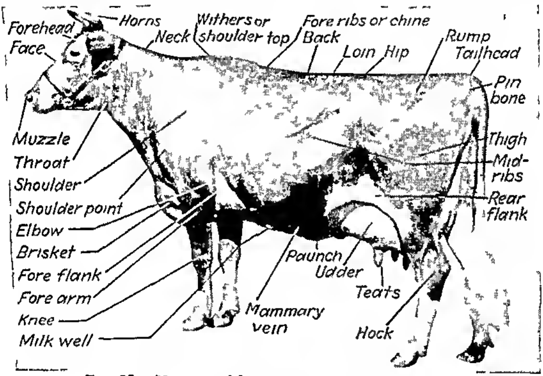


FIG 35 Names and locations of parts of a dairy cow

balanced and has a masculine head, a straight back, and a long, wide, level rump. In dairy character, he shows a clean-cut appearance with freedom from beefiness in the thighs and other parts of the body. The skin is loose and pliable and the hair fine. The body capacity is large in proportion to the size of the animal, and the heart girth is also large as a result of a wide chest floor and well-sprung forerībs. The legs are medium in length, straight, and squarely placed. The feet are short and well rounded.

Pedigree. Some of the considerations in inspecting the pedigree are discussed on page 55 in connection with selecting a dairy heifer or cow. Give preference to a bull which comes from strains or families

in which the individuals average large for their breed and in which the cows have well shaped udders and are consistently high producers

Transmitting Ability As explained further in Chap 7, it is especially desirable to secure a dairy bull that has proved himself by siring daughters that are consistently better producers than their dams If such a bull is not available, secure the son of a proved sire Some indication of a bull's probable influence can be obtained from the mother's side of the pedigree The mother should be a member of a good cow family as shown by being a good producer herself, with sisters and daughters that are all consistently good producers

For improving a herd with low production, a purebred bull with a fairly good ancestry will usually bring about some increase in the production through the daughters that he sires For improving higher producing herds, the selection of a suitable sire becomes increasingly difficult, as discussed further in Chap 7 Some breeders can secure the services of a good sire through artificial insemination, as explained in Chap 7

5 Selecting Beef Cattle

Choosing Breeds In getting started with beef cattle, choosing a breed is a chief consideration The breeds most frequently found in the United States are the Hereford, Polled Hereford, Shorthorn, Polled Shorthorn and Aberdeen Angus

Selecting Beef Breeds Color is one of the aids to identifying beef breeds The Herefords are red and white in color The head is uniformly white which accounts for the nickname "whiteface" White also occurs on the underline, along the top of the neck, on the switch of the tail, and on the lower parts of the legs The Shorthorn may be red, white, or any combination of these colors, such as spotted or roan The breeds of Polled Hereford and Polled Shorthorn are offshoots from the Hereford and Shorthorn breeds respectively, that have been developed with the characteristic of being "polled," or hornless Cattle of the Aberdeen Angus breed, usually called "Angus," have short, black hair and heads without horns

In the United States the Shorthorn breed is the most widely distributed of any breed, although the Hereford predominates in the range states because of a combination of ruggedness and "rustling" ability under range conditions Most of the feeder cattle from the range states of the West and Southwest show whitefaced character

istics of the Hereford breed, since purebred Hereford bulls have been extensively used for the improvement of range cattle. The Angus is the smallest in size of the beef breeds; while it is not as good a forager as some breeds, it is outstanding in quality. Cattle of this breed make excellent show animals, as they are low-set and blocky in appearance. Animals of the *Shorthorn breed* average *the largest of any breed,* and the cows are usually better milkers than those of the other beef breeds. The Polled Hereford has increased in popularity because of the hornless characteristic. Bulls of this breed are frequently mated with horned cows. Most of the offspring from these crosses are hornless.

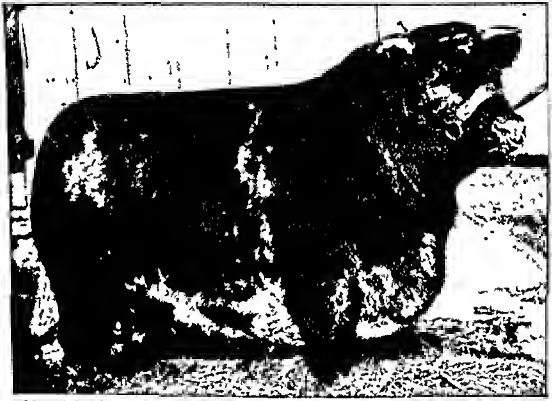


FIG. 36. A beef-type Shorthorn bull. (*American Shorthorn Breeders Association*)

Of the beef breeds included above, the Hereford and Shorthorn originated in England and the Aberdeen Angus in Scotland. The Polled Shorthorn and the Polled Hereford originated in the United States. The Hereford derives its name from Herefordshire, a county in England. The Shorthorn probably received its name from its characteristic of short horns, although the name Durham was used for this breed in its early history after a county of that name in England; this name is still used in some sections. Breeders in Scotland also contributed much to the early development of the Shorthorn breed, especially to the strictly beef type, while many of the English

breeders emphasized milking qualities as well. It was from the latter strains that the breed of Milking Shorthorns was developed The Aberdeen Angus breed originated in Scotland and derives the first part of its name from the county of Aberdeen The last part of the name was derived from the county of Angus

Selecting Brahman and Brahman-cross Cattle During recent years, cattle ranchers, notably in the Southern states, have begun the breeding of the Brahman and Brahman-cross type of cattle Brahman cattle are native to India, where they are known as sacred cattle and never

Fig 37 A Hereford bull (*Photograph by Smith*)

killed intentionally or used as meat They are worked, however, and the cows are milked and the milk is used as food They belong to a species of cattle characterized by a hump extending over the shoulder and neck

About the year 1900, several Southern cattle ranchers imported a few cattle of this type from India American ranchers became interested in them due to the fact that their peculiar oily skin secretion prevents the cattle tick from using them as a host Since the cattle tick is the carrier of the virus that causes splenetic or "Texas" fever, this makes the Brahman practically immune to this disease Besides possessing this advantage for Southern ranching, Brahman cattle have sweat glands

in the skin and withstand hot weather with much less discomfort than European cattle. They therefore make better grazers and achieve more rapid growth on Southern ranches than cattle of the British breeds.

Since pure Brahman cattle did not produce highly desirable beef carcasses, a few ranchers tried crossing the Brahman on the Hereford and Shorthorn breeds. It was found that the crossbreeds were immune to the tick, withstood hot weather well, and grew faster than the cattle of the pure- or high-grade European beef breeds. The hump almost

FIG. 38 A Braham bull of the Guzerat strain (*The Cattleman.*)

disappeared in the first cross and the crossbreds produced much more desirable carcasses than the pure Brahmans.

Among the ranches that became interested in the breeding of Brahman and Brahman-cross cattle at an early date was the King Ranch, known as the Santa Gertrudis, at Corpus Christi in the extreme southern part of Texas. By crossing Brahman bulls on Shorthorn cows and then by selecting and breeding within the cross, the King Company developed a new strain of cattle that is now recognized as the Santa Gertrudis breed. Several different strains of Brahman cattle differing appreciably in type have been imported, and crosses have been made on several of the leading beef and dairy breeds.

The pure Brahman, especially those of the Guzerat strain, which seems

most nearly to resemble beef type, has the characteristic hump over the shoulder and neck Such animals are a light gray or mouse color They are medium in length of leg, deep in the body, and rather thick-fleshed throughout The head and legs are moderately large and coarse in appearance Cows should weigh 1,000 to 1,200 lb and bulls, 1,700 to 1,900 lb Brahman cattle have a characteristic long drooping ear The skin is loose and mellow and inclined to be excessive at the dewlap and about the navel

Although some Brahman cattle must be bred pure to produce sires for crossing, it is the Brahman cross strains in which the Southern cattle rancher is most interested Crosses made with the dairy breeds give promise of successfully combining the desired qualities of the Brahman with the dairy type just as was accomplished with the beef type

Selecting a Beef-type Heifer or Cow. In selecting a beef-type heifer or cow, the primary aim is to secure a female that will produce fast growing offspring capable of fattening rapidly and making attractive carcasses when slaughtered Further information on measures of efficiency in beef cattle is given in a later paragraph and in Chap 7 Appearance, pedigree, performance, and transmitting ability are important factors in selecting a beef-type female

Appearance or Type In selecting a heifer or cow by appearance or type, place emphasis on (1) general form, (2) size or weight for age, (3) quality, (4) constitution, and (5) natural fleshing or development in regions of the high priced cuts of meat In learning to judge an animal, first become familiar with the location of various parts as shown in Fig 39

In general form, a desirable heifer or cow is low set, blocky, compact, and well balanced The topline and underline are straight The head is wide and fairly short, and the muzzle is broad The shoulders are compact, and the body is deep and wide, showing uniformity of width throughout The rump is long, level, and wide The legs are straight and fairly short In breed type, select an animal which conforms to the characteristics desired for the breed to which she belongs

Select a beef female that is large for her age but do not emphasize weight for age to the extent that quality is neglected At one year of age, a "growthy' heifer of any of the beef breeds weighs around 700 lb or more Formulas for estimating weight from body measurements are sometimes used

Quality is indicated by thinness of skin and fineness of hair and bone

The handling qualities of the skin are determined by rolling a portion between the thumb and fingers. If of good quality, the skin is fairly thin and pliable. The bone is preferably medium in size as determined by the size of the shanks and the general framework of the animal. Quality is also shown by smoothness of fleshing in animals carrying considerable condition. "Patchiness" (collecting of fat in bunches) is undesirable.

The constitution of an animal is judged by noting the size of the chest region. In animals of approved type, the floor of the chest is wide, as shown by considerable width between the front legs and a deep body in

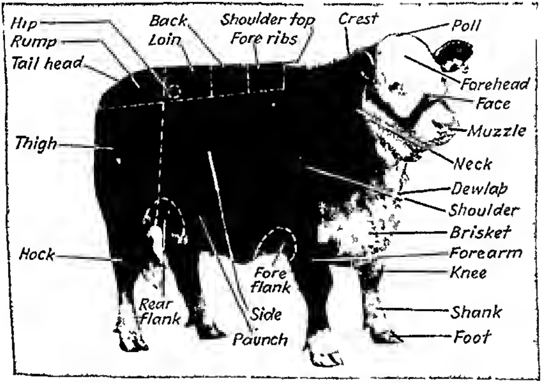


Fig. 39. Names and locations of parts of a beef animal.

this region. The foreribs are well sprung. All these features contribute to a large heart girth.

A desirable cow or heifer, when in breeding condition, shows good development or natural fleshing in the regions of the high-priced cuts of meat. Such animals have a wide loin, well-developed rear quarters, and a fair amount of covering over the ribs. The location of these parts can be noted in Fig. 39.

Pedigree. If a purebred heifer or cow is purchased, inspect the pedigree or secure whatever information is available about the ancestors. Animals of known merit in type and rapidity of growth should appear as close-up ancestors.

Performance. One of the best measures of efficiency for beef cattle is the rapidity of growth. Females in good breeding condition preferably weigh around 400 lb. or more at six months of age and about 700 lb. or more as yearlings. In purchasing a cow, note her reliability as a breeder by finding out whether or not she has produced a calf regularly each year after she became of breeding age.

Transmitting Ability. If a mature cow is to be selected, it is frequently possible to see some of her offspring and note whether or not she has consistently transmitted good qualities to them. If possible, inspect the sire

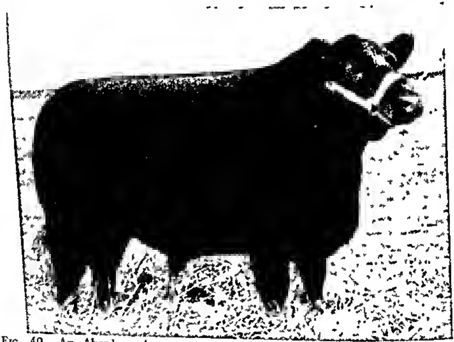


FIG 40 An Aberdeen Angus steer. Near ideal in beef type. *(Photograph by Abernathy.)*

and dam, as well as sisters and brothers and half sisters and half brothers, of the heifer or cow under consideration. If they are uniformly good, they furnish further evidence that the strain or family is prepotent for the desired qualities.

Other Factors. Consider the general thriftiness and health of the heifer or cow. Secure one that is free from tuberculosis and Bang's disease as shown by recent tests and that is from a herd accredited for freedom from tuberculosis and Bang's disease. You may prefer to purchase a young heifer at around six months of age, or you may wish to secure a bred heifer. If a cow is to be purchased, usually one that is pregnant

is preferable, as there is more certainty that she is a reliable breeder. If the heifer or cow is bred, investigate the caliber of the bull to which she was mated. Check to see if she is bred to have a calf at the time of year a calf is desired. A heifer should not be bred to calve before she is twenty-seven months old. Since the beef female is usually expected to supply sufficient milk for her calf, check the soundness of the udder and the development of the udder and teats. Pay a price that is in keeping with the qualities of the animal.

Selecting a Beef-type Bull. In selecting a bull, consider characteristics similar to those suggested for selecting a heifer or cow. The bull should be a purebred in all cases; you can afford to pay a higher price than for a single female if the animal is superior as an individual and as a prospective breeder. However, price alone is not necessarily indicative of the true value of a bull in a herd. Secure an animal that is masculine in appearance and larger at a given age than a female. For a bull six months of age in average condition a desirable weight is around 500 lb. or more; for a yearling, around 850 lb. or more. If a mature bull is being considered, ask to see some of his offspring to note his transmitting ability. For either a young or a mature bull, inspect the sire and dam, if still available, as well as any sisters and brothers, half sisters and half brothers at hand, to note uniformity in desirable type.

A further discussion of the selection of bulls for improving beef herds will be found in Chap. 7.

Selecting Feeder Cattle. In selecting feeder cattle, consider (1) form or type, (2) weight for age, (3) quality, (4) constitution, and (5) natural fleshing or development in the regions of high-priced meat cuts. Where several animals are to be fed together, it is desirable to have them uniform in size, condition, and quality. The age at which to purchase feeder cattle will depend upon the age and weight at which they are to be marketed and the corresponding length of time which would be necessary to get them into market condition.

In selecting feeder steers, keep in mind that the appearance of the unfattened animal is not an accurate guide in determining such factors as rate of gain, dressing percentage, and cutout values of the fattened animal. Consequently, it is desirable to secure feeder cattle from farms or ranches that have been found to produce fast-growing, easily fattened stock.

In securing feeder cattle, bear in mind that to put on 100 lb. of gain will frequently cost as much as, or more than, will be received per

hundredweight for the animals when marketed Under these conditions you must purchase feeder cattle at a lower price per 100 lb than you expect to receive when you sell them as fattened animals This difference between the cost of the feeder cattle and the selling price of the finished animals stated in dollars per hundredweight is called the margin To determine the margin that will be needed in feeding a particular bunch of cattle consider the cost of feed per 100 lb of gain and other costs The value of the manure and the pork from the hogs running with the cattle may cover most of the expenses other than cost of feed

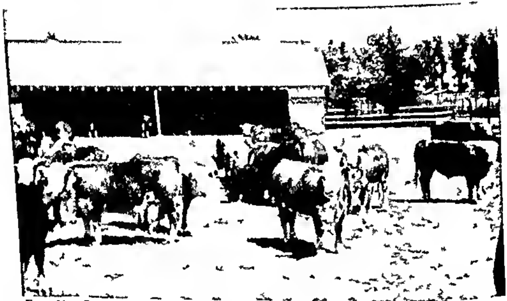


Fig 41 Prime steers ready for market Producing such animals requires high quality feeders and the right ration, however they may not always be the most profitabl

As an example of figuring margins, suppose that some 700 lb yearlings could be secured for $34 per hundredweight delivered to the feed lot They would be fed 180 days and would require feed costing about $38 per hundredweight of gain for a total gain of about 360 lb each The initial cost per steer would be $238, and the cost of 360 lb of gain would be $136 80 making a total cost per head of $374 80 at the time the steers would be in market shape at a weight of 1,060 lb To break even these steers would need to bring $35 36 per hundredweight, which is a margin of $1 36 over the cost price per hundredweight Unless they were likely to bring more than $35 36 per hun

dredweight on the market, it is doubtful if the venture would be profitable.

The amount of margin necessary is determined by a number of factors. Other factors being equal, light cattle require a wider margin than heavy cattle; low-priced cattle require a wider margin than high-priced cattle; high feed costs require wider margins than low feed costs; or cattle fed for long feeding periods require wider margins than cattle fed for short periods. It can be seen that a wise buyer of cattle will give careful attention to the problem of margins. Further-

FIG. 42. An Aberdeen Angus bull. (*Photograph by Smith.*)

more, it is desirable to make careful estimates of the expenses including the original cost of feeder cattle, the cost of feeds, and other items, as well as the probable selling price. By securing low-cost gains through the maximum use of pasture and limited amounts of grain, it is actually possible to feed cattle at a profit with little or no margin. In other words, under these conditions, cattle may show a profit even if they are purchased at a higher cost per hundredweight than they bring on the market.

It does not always pay to buy the best quality of feeder cattle. In fact, a feeder of beef cattle must be a shrewd judge of values. Carefully weigh such factors as feed costs and the price paid for the

feeder stock Well bought is half sold is a slogan to which wise cattlemen give careful consideration

6 Selecting Dual purpose Cattle

Choosing Breeds of Dual purpose Cattle. Two breeds of cattle, the Red Polled and Milking Shorthorn are commonly recognized as being of combination milk and beef or dual purpose type rather than of purely dairy or purely beef type The term "dual purpose' used in distinguishing cattle of this type from those of the dairy and beef

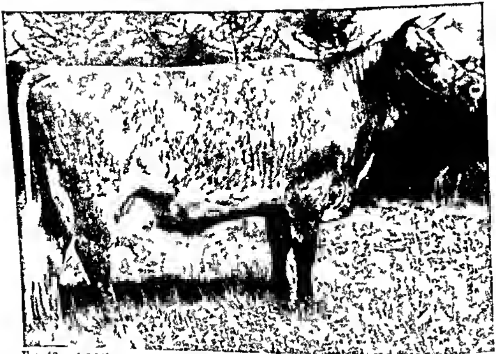


Fig 43 A Milking Shorthorn cow (*The American Shorthorn Breeders Association*)

types implies that they are suited to both milk and beef production It is logical to assume that in selecting cattle of the dual purpose type the standard for selection would be a combination of those qualities essential to milk production and those essential to beef production resulting in an animal with an appearance midway between the extreme in dairy type and the extreme in beef form

The two breeds of dual purpose cattle originated in England The Red Polled, as the name indicates, is a medium to dark cherry red in color, and without horns A small amount of white color about the udder and in the switch of the tail is permissible Cattle of the

Red Polled breed were first brought to the United States in considerable numbers during the decade 1880 to 1890. Red Polled cattle have a general but sparse distribution throughout the mixed-farming areas of the United States with their heaviest concentration in the Corn Belt region.

The Milking Shorthorn is in reality one of the presently recognized three strains of the Shorthorn breed. It is nevertheless commonly accepted as a distinct breed. Most of the early cattle of the Shorthorn breed in England more nearly possessed characteristics of the present-day milking type than of the present-day beef-type Shorthorn. Eng-

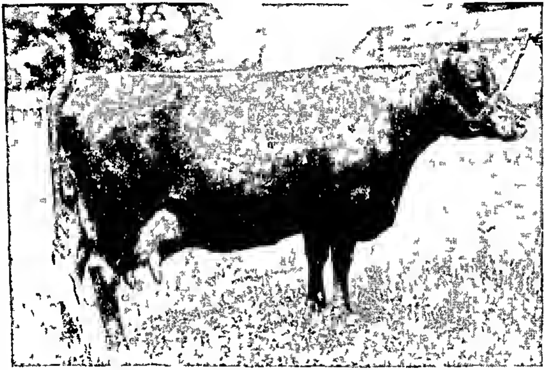


FIG. 44. A Red Polled cow (*Photograph by Strohmeyer*)

lish breeders have for the most part continued to select and breed Shorthorns of dual-purpose type. The beef-type Shorthorn is in reality an offshoot of the dual-purpose type developed by breeders in Scotland, who selected cattle most nearly approaching beef type from English herds and then proceeded to select and breed toward the purely beef type.

Cattle of the Milking Shorthorn strain or breed were among the earliest of all the pure breeds of livestock to be introduced into the United States from Great Britain. It is believed that a few cattle of this breed were imported from England during the period 1800 to 1825. Many had been imported by 1850. Later many American breeders used sires of the beef-type Shorthorn strain and thus in time converted

their herds into purely beef-type herds The Milking Shorthorn at present has its distribution largely in the mixed-farming areas, with heaviest concentration in the Corn Belt Colors of the Milking Shorthorn are red, white, and roan Cattle of this breed normally have horns, although a few breeders have introduced the polled characteristics into their herds and advertise the type as Polled Milking Shorthorns

Selecting a Dual-purpose-type Heifer or Cow. In selecting the dual-purpose heifer or cow, an attempt is made to select a female that will produce or become a moderate producer of milk and, at the same time, produce a calf that can be developed into a reasonably desirable and profitable beef animal Most breeders of dual purpose cattle consider 8 000 to 10,000 lb of milk and 270 to 360 lb of butterfat to be a satisfactory range in milk and butterfat production for mature dual purpose cows Many breeders keep milk and butterfat production records in the same manner in which such records are kept by dairy cattle breeders These records are then used to aid in selecting females to be retained in the breeding herd In this connection care must be exercised to avoid overenthusiasm for high milk and butterfat records, thus leading to selection toward purely dairy type cattle and loss of the dual purpose type in the herd

Appearance or Type In selecting the dual purpose heifer or cow by appearance or type, emphasis should be placed on (1) general form, (2) size or weight for age, (3) quality, (4) constitution, (5) natural fleshing, and (6) development of the mammary system

In general form, keep in mind a type midway between the approved type for dairy cows and heifers and the approved type for beef cows and heifers The best way such a type can be described is to say that the cow or heifer should appear medium to short in length of leg, deep in body, medium in width of body, and medium in flesh covering throughout About the same weight for age is expected as in beef cattle Mature dual purpose cows of the Red Polled breed should weigh around 1,200 lb in moderate condition while Milking Shorthorn breeders think of 1,300 to 1,400 lb as a desirable weight for a mature Milking Shorthorn cow

Quality and constitution are judged in exactly the same manner as in judging beef cattle

A smooth, uniform covering of natural flesh is desired even for the cow in milk Somewhat less thickness of muscle development and flesh

covering than the standard for cattle of purely beef type must be expected.

Give considerable attention to the mammary system in mature cows. One of the common faults of both breeds of dual-purpose cattle is a tendency to poorly balanced, sometimes fleshy udders, with teats either too large or too small. The same principles apply in examining and judging the udders and teat placement of dual-purpose cows and heifers as for dairy cows.

Pedigree. In studying and evaluating the pedigree of the dual-purpose animal, the same importance must be placed on production records as in the case of the dairy pedigree, except that amounts of milk and butterfat desired are scaled down to considerably lower figures, as previously indicated. The degree to which ancestors through several generations conformed to approved dual-purpose type in their appearance is of special importance, because maintaining the desired intermediate form and appearance is one of the difficult features in breeding dual-purpose cattle.

Other Factors. All other factors of importance in selecting breeding cattle for purchase, such as transmitting ability, the health of the herd, influence of age on value, and price asked, must be considered in the same manner as in selecting either dairy or beef cattle.

Selecting a Dual-purpose-type Bull. A typical dual-purpose-type bull of either the Red Polled or Milking Shorthorn breed should weigh 1,800 to 2,000 lb. in moderate flesh at maturity. The characteristic appearance of the dual-purpose bull should be intermediate between that of the bulls of the dairy and beef types. Breeders desirous of maintaining true dual-purpose type in their herds must pay special attention in selecting a sire to those characteristics indicating sufficient beefiness of form; otherwise the type in the herd will surely tend toward the special-purpose dairy type. Production records in the pedigree of the bull are of just as much importance as they are in the cow or in the pedigree of the cow. The progeny test is the most reliable in the selection of the dual-purpose-type bull. It is perhaps of greater importance and value in selecting bulls of the dual-purpose type that they be old enough to have demonstrated their suitability as a sire by the type and efficiency of their offspring than is the case in selecting sires of any other breed of livestock. The breeder of dual-purpose cattle will be wise to make every effort to secure tried, successful sires to use as herd bulls in his herd.

7 Selecting Sheep

Choosing Breeds It is more difficult to identify the separate breeds of sheep than the breeds of other kinds of livestock While there are more than 40 breeds of sheep only about half this number have been introduced into the United States and of these only about a dozen

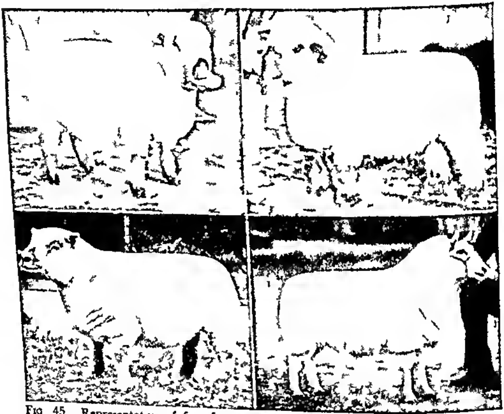


Fig 45 Representative of four breeds of the medium wool type of sheep *upper left* Shropshire ewe *upper right* Hampshire ram *lower left* Southdown ewe *lower right* Cheviot ewe (*First three photographs by Abernathy fourth by Strohmeyer and Carpenter*)

breeds are numerous enough to be commonly known Based on the nature of the wool the breeds may be grouped into three main classes —long wool breeds medium wool breeds and fine wool breeds Since the first two classes are raised primarily for meat purposes with wool as a secondary product they are commonly referred to as 'mutton type The fine wool breeds were formerly raised primarily for wool production but meat is now of first importance in raising them Because of the fineness of fiber of the wool produced these breeds are still referred to as the wool type or fine wool type

The breeds of sheep that predominate in the Middle Western and Eastern part of the United States are the Shropshire, Hampshire, and Oxford Down. The Southdown, Cheviot, and Dorset Horn are among the other breeds represented in these sections. All these breeds are mutton type and of the medium-wool class. They can be differentiated from each other by certain head characteristics and body type. Sheep of the Shropshire breed are among those most popular of any of the mutton-type breeds, as they combine good mutton qualities with heavy fleeces of good quality. The Shropshire is medium in size, fairly low-set, and broad and deep in body, and of the breeds mentioned it is the most completely wooled over the face and on the legs. The parts of the ears, nose, and legs not covered with wool are a dark brown or black in color.

The Hampshire is larger than the Shropshire. The head is large and the nose is slightly Roman in shape. The ears are large and somewhat drooping. The hair on the face and legs is black. The Oxford is a large, upstanding sheep. The face has less wool than is found on the Shropshire, and the hair on the face, ears, and legs is brown in color, usually mixed with gray. The Southdown is the smallest of the breeds named; it is an extremely low-set, blocky sheep. The hair on the face, ears, and legs ranges from a brown to a light gray color. The Cheviot is a small sheep identified by white hair on the face and legs, by erect ears, and by a head that is free from wool from the ears forward. The Dorset is large in size and is the only one of the breeds mentioned so far that develops horns, both rams and ewes producing them.

The long-wool breeds include the Cotswold, Lincoln, and Leicester. These breeds are large in size and produce loose, open fleeces inclined to curl in ringlets at the surface. They are not commonly found in the United States.

The common breeds of the fine-wool type are the Merino and Rambouillet. The influence of these two breeds is apparent in sheep on ranches in the Western states. They are rugged, good grazers and have the flocking instinct well developed. This makes them readily adaptable to range conditions. The Merino is well covered with wool, and the skin of certain strains carries a number of wrinkles or folds on the body. The differences in wrinkling have led to three groupings for show purposes, designated as A, B, and C. The A group includes those wrinkled over the entire body, the B group has wrinkles only in the neck region, and the C group (frequently called Delaine) has no

noticeable wrinkles. Merino rams develop horns, while ewes do not. The hair is white on portions not covered with wool, that is, the ears, nose, and lower parts of the legs. The body of some wool-type breeds of sheep is small, and in comparison with some of the mutton breeds it may be somewhat lacking in mutton form; however, some strains of the C, or Delaine, group are quite good in this respect. On the range,

Fig. 46. Representatives of the fine-wool breeds of sheep: *upper left*, Rambouillet ram; *upper right*, Merino ram. Representatives of the long-wool breeds: *lower left*, Lincoln ram; *lower right*, Cotswold ram. (*Photographs by Abernathy and Strohmeyer.*)

crosses with other breeds are frequently being made to bring about improvement from the mutton standpoint.

The typical Rambouillet is a fairly large sheep of the fine-wool group with a good mutton form. There may be some wrinkling of the skin at the neck in certain individuals. The rams usually have large, heavy, curled horns. The hair on the portions not covered with wool is white. Rams of this breed have been extensively used for improving flocks of Merinos on the Western ranges. Many present-day breeders of Ram-

bouillets for range flocks are selecting individuals free from wrinkles or folds on their bodies, and they give preference to open-faced individuals as shown in Fig. 217, page 382. The sheep that are free from body wrinkles are more easily sheared than wrinkled sheep and produce as much or more clean wool. Open-faced sheep are better grazers than sheep that are "wool-blind" from too much wool on their faces, as explained later in connection with selecting a ewe.

Fig 47. A Corriedale.

The Merino originated in Spain, the name being the title of a Spanish governmental officer who assigned grazing lands to different bands of sheep. The Rambouillet is a native of France, deriving its name from the town of Rambouillet, in which a governmental experimental farm for sheep was located.

The Shropshire, Hampshire, Oxford Down, Southdown, Dorset Horn, Cheviot, and Suffolk originated in the regions of low hills, known as "downs," in central and southern England The names of the Shrop-

shire, Hampshire, Dorset, and Oxford were taken from names of English counties. The Southdown was named after a belt of hills called the South Downs. The Cheviot was named after the Cheviot Hills, which are located on the border between England and Scotland. The Suffolk, named after a county in England, is extensively used for crossing on range ewes in producing market lambs. The Lincoln and Leicester originated in England and derived their names from counties in that country. The Cotswold breed was started in the region of the Cotswolds in England.

FIG 48 A Columbia ram This is a new breed produced in the Northwest range states from a cross of the Rambouillet and long-wool breeds The typical Columbia is large, smooth-bodied, open-faced, and produces a heavy fleece (*Sheep Experiment Station, Dubois, Idaho U.S Department of Agriculture*)

Another breed found in some of the Western states is the Corriedale. This breed originated in New Zealand and was named after the Corriedale estate in that country. The breed was started by crossing some rams of the long-wool breeds on Merino ewes. Corriedales have many of the characteristics of the medium-wool breeds, as they are valuable for both wool and meat. Sheep of this breed are white-faced, with a medium amount of wool on the face and legs. They are of good size and vigorous.

Two breeds of sheep recently developed in the United States are becoming quite popular, especially in the West. Starting about 30 years ago, the Columbia was originated from crosses between Lincoln rams

and Rambouillet ewes. As a result of careful selection under the direction of specialists at the U.S. Sheep Experiment Station at Dubois, Idaho, sheep of this breed are large and vigorous. The lambs grow rapidly and reach market weight at an early age under range conditions. These sheep are white-faced and hornless. They have open faces, and their bodies are free from folds or wrinkles. They produce heavy fleeces of medium-quality wool. The Columbia can be classed as a medium-wool, mutton breed

The Targhee breed has been developed since 1926 at the U.S. Sheep Experiment Station in Idaho and derives its name from the Targhee

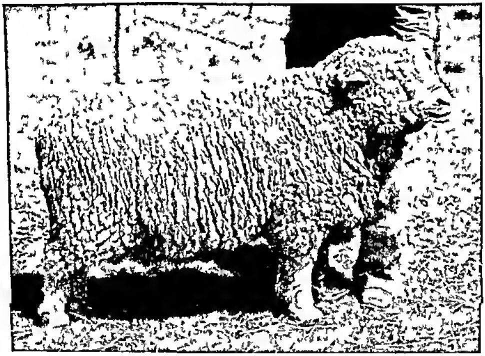


Fig 49 A Targhee ram This breed of sheep was produced in the Northwest range states from a cross of the Rambouillet type of ram and the long wool ewe (*Sheep Experiment Station, Dubois, Idaho U S Department of Agriculture*)

National Forest in that state This breed was started from a combination of approximately one-fourth Lincoln and three-fourths Rambouillet breeding, with some mixture of Corriedale breeding. The Targhee is especially well adapted to ranges 5,000 to 8,500 ft. in altitude with a sagebrush covering The fleeces are finer than the Columbia; but, like the Columbia breed, the sheep have a desirable mutton conformation, the lambs grow rapidly and reach market weight at an early age under range conditions, and the sheep are open-faced with bodies free from wrinkles.

The Montadale is a new breed of sheep developed from crosses be-

tween Columbia ewes and Cheviot rams, followed by careful selection for several generations. Sheep of this breed have open faces, and the lambs grow rapidly. The fleeces are of good quality and weight. This breed is one of the medium-wool group.

Comparing Wool from Various Breeds. The various breeds differ with respect to fineness and length of the wool fibers that comprise their fleeces The fine-wool breeds, as the term implies, have the finest wool, but the fibers are shorter than in other breeds. The wool of the long-wool breeds is the coarsest of the three groups. The medium-wool breeds are intermediate with respect to length and fineness of wool

FIG 50 A Montadale yearling ram (*Montadale Sheep Breeders Association*)

fiber. In general, it is desirable to produce wool with a fine fiber and of fair length. On the market, there are seven established grades of wool, based on fineness and length of fiber. These grades are "fine," "half blood," "three-eighths blood," "quarter blood," "low quarter blood," "common," and "braid." (For a further discussion of wool grades, see Chap 9.) These terms originally referred to the percentage of Merino or fine-wool breeding that animals carried, but today they are used only to designate grades of wool based on degree of fineness. Individuals within a breed differ with respect to the grade of wool produced, but in general the wool from the various breeds of sheep grades as follows:

Merino	Fine
Rambouillet	Fine to half blood
Targhee	Half blood
Southdown	Half blood to three-eighths blood
Montadale	Three-eighths blood
Suffolk	Three-eighths blood
Shropshire	Three-eighths blood to quarter blood
Hampshire	Three-eighths blood to quarter blood
Columbia	Three-eighths blood to quarter blood
Corriedale	Three-eighths blood to quarter blood
Dorset Horn	Quarter blood
Cheviot	Quarter blood
Oxford Down	Quarter blood to low quarter blood
Cotswold	Common and braid
Lincoln	Common and braid
Leicester	Common and braid

In production of lambs, ewes of the fine-wool breeds have the lowest percentage of twins, while a fairly high percentage of the ewes in the long-wool breeds and in some of the medium-wool breeds produce twins. However, the tendency toward twinning may be stimulated to some extent by having the ewes in thrifty condition at breeding time.

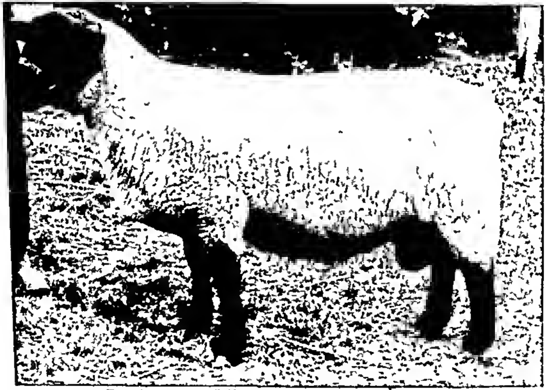


FIG. 51. A Suffolk ram (University of Idaho.)

Selecting Karakul Sheep. The Karakul is a fairly new type of sheep in the United States that is assuming some significance; it is often classed as a long-wool breed. Originating in the country of Bokhara in south

central Asia the Karakul is a product of natural selection rather than controlled selection toward a standard type Mature Karakuls are medium in size poor in mutton form and produce a long fleece of coarse fiber resembling hair more than wool The fleece varies from gray to dark brown in color The face and legs are bare of wool and are covered with short grayish brown or black hair The rams have horns the ewes do not One peculiar characteristic is a tendency in mature sheep to develop a large deposit of fat in the rump and about the tailhead It is said that this characteristic is a result of the irregular feed supply in the native home of the Karakul The fat deposit is developed

FIG 52 A Karakul ewe and lamb (*D S Jones Friendship Wis*)

during periods of good grazing following rains and is drawn upon by the sheep for its own maintenance during long drought periods

The product of the sheep of Bokhara that attracted attention to them and brought about their introduction to the United States is the characteristic fleece of the lambs at time of birth It is jet black, has high luster, and has curls in tight ringlets close to the skin The lambs are slaughtered at one to two days and the pelts used to produce Persian lamb furs

Most of the Karakul sheep produced in the United States have been sold to start new flocks A few breeders have slaughtered some lambs from which the pelts have been processed into fur It has been found that some strains produce good fur pelts, while others do not As yet

satisfactory pelts have not been produced by crossing the Karakul with either mutton or fine-wooled breeds. Selection of Karakul sheep for breeding use must be based mainly on the type and quality of pelt produced by the lambs.

Selecting a Ewe. In selecting a ewe, the primary aim is to secure an individual of desirable mutton conformation that produces a good quantity and quality of wool and transmits tendencies for rapid growth, good fleeces, and desirable market qualities to its offspring. A reasonable standard is for each ewe to produce a fleece with fairly long fibers of

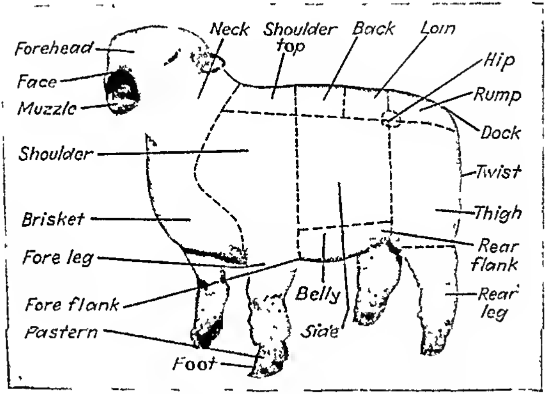


FIG. 53 Names and locations of parts of a sheep.

good-quality wool, the fleece weighing 10 lb. or more, and at least one lamb per year weighing 80 lb. or more at 130 to 140 days of age. Further information on standards of production is given in Chap. 7.

Appearance or Type. In selecting a ewe by appearance or type the eye must be aided by the hand, since in most cases much of the body is obscured by the fleece, unless the sheep has been shorn recently. For this reason, whenever possible, select a ewe shortly after shearing time. At any rate, do not be deceived by a sheep with considerable wool that appears blocky, as sheep for show or sale may be "blocked out," or trimmed, to give this impression.

In judging sheep, give attention to (1) general form or type, (2) size

for age, (3) constitution, (4) natural fleshing, and (5) fleece A person should become familiar with the location of various parts of a sheep, as shown in Fig 53

A desirable ewe has a broad, deep body of medium length The legs are of medium length The back is straight and wide, and the rump is wide and level The head is broad and fairly short The ewe if purebred should show the characteristics desired in the breed to which she belongs

In the case of the mutton breeds, place more stress on meat type than with fine wool breeds although increased stress is now being placed on meat qualities in the fine wool breeds

Select a ewe that is large for her age and breed At five months of age, a ewe lamb should weigh 75 to 90 lb Estimating the weight of a sheep is a difficult job and proficiency comes only with study and experience

A good constitution is shown by depth at the shoulder region, by a wide forerib, and by considerable width between the front legs

When considering type in a ewe, give attention to the natural fleshing or general development in the regions of the high priced cuts These include a broad, well covered loin, well covered ribs, and well developed rear quarters However, ewes that have done a good job of nursing lambs can be expected to be thin for a time after their lambs are weaned

In judging the fleece, give attention to length, weight, and quality One evidence of a heavy fleece is the density as noted by compressing the wool between the fingers and palm of the hand Give preference to long fleeces reasonably fine in quality, as noted by parting the wool and inspecting the fibers at various places along the sides of the body

In range flocks especially select breeding animals that have little or no wool around the eyes and on the face Too much wool in these regions interferes with the ability of the sheep to see properly, such sheep are said to be "wool blind" This handicaps them in feeding and in finding their way about Open faced lambs are preferred as they gain more rapidly, and open faced ewes are desired because they average more pounds of lamb per ewe owing to heavier milk production Experiments show that open faced sheep produce just as much or more wool than those with a large amount of wool on their faces (see Fig 217, page 382)

In the fine wool breeds select sheep with few or no wrinkles in the skin around the shoulders and neck Such sheep are easier to shear

and they produce as much or more clean wool of more uniform quality than sheep with heavy wrinkles or folds of skin.

Pedigree. In studying the pedigree, which should be available for a purebred ewe, see whether the names of any noteworthy parents or grandparents appear. Of course, where possible, these ancestors should be inspected firsthand, as mentioned below.

Performance. If the ewe under consideration has been shorn, secure any information possible on the weight of the fleece and market grade of the wool produced. Also, if she is old enough to have raised lambs,

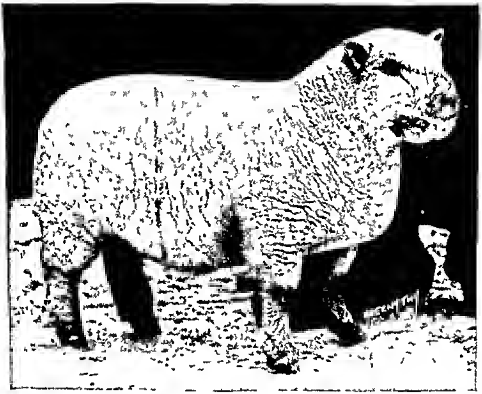


Fig. 54. Southdown wether lamb showing near ideal in mutton form (*Photograph by Abernathy.*)

determine how regularly she has been a breeder. Some of the information desirable for determining performance of a ewe is included in a record form (page 422).

Transmitting Ability. If the ewe has produced lambs, ask to see them and note their type and weight at a given age. For either a young or an older ewe, note these characteristics in the brothers and sisters and half brothers and half sisters. Whenever possible inspect the dam and sire also. Prepotency, or transmitting ability, is considered further in Chap. 7.

Age and Other Factors. In selecting a ewe, consider her age and know how to determine this by the teeth.

The age of a sheep can be determined readily from the four pairs of teeth in the front part of the lower jaw In lambs, these teeth are small, thin, and white The middle pair of lamb teeth is replaced by longer, wider and heavier teeth at one year of age The next pair of permanent teeth comes in, one on each side of the first pair, at two years of age, the third pair at three years, and the last pair, or "corners," at four years After that the age can be estimated only by the amount of wear on the teeth, which causes them to become shorter As a sheep gets quite old, some of the teeth may drop out and it is said to have a "broken mouth"

The ewe should be in good health as shown by a thrifty condition

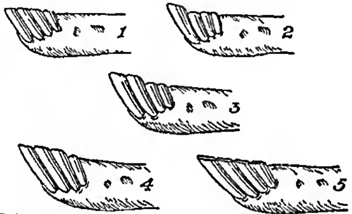


FIG 55 Left half of lower jaw of sheep showing appearance of teeth at different ages (1) all lamb teeth (2) one pair of lamb teeth replaced by permanent teeth the yearling age (3) two pairs of lamb teeth replaced the two year age (4) three pairs of lamb teeth replaced the three year age (5) all lamb teeth replaced the four year age (*Cornell Rural School Leaflet Vol 22 No 3*)

Sometimes a ewe that is a good milker and has nursed one or two vigorous lambs will be quite thin, whereas a ewe that has not raised a lamb or was a poor milker may be in good condition Consequently, if possible, secure information on the lambing history of the ewe

Check the ewe s udder for soundness by feeling the udder tissue to determine if it is soft and pliable, and note if both teats are sound

Sometimes you can purchase older ewes at a low enough price to justify buying them, especially if their lambing record has been good and their offspring of good quality Even if only one more lamb crop is raised, this might be a means of getting a start in high quality stock with a reasonable outlay of money

Selecting a Ram As in selecting sires for other kinds of livestock,

first of all insist on a purebred. In selecting a ram, consider all that has been said about selecting a ewe, and in addition note evidences of masculinity. Secure a ram that has strong feet and legs. In selecting a ram, give special emphasis to the weight for age.

If only about a dozen ewes are to be bred, a ram lamb may be secured. For more than this, a yearling or older is preferred. A ram kept under good conditions should be serviceable up to five years of age. Frequently a good "tried," or "tested," ram three or four years of age can be obtained at a reasonable price. In the case of a tried ram, it is possible to check on his reliability as a breeder and on his transmitting ability.

Selecting Feeder Lambs. In purchasing lambs to fatten for market, secure animals that fatten rapidly and economically. Consider such items as (1) type or form, (2) breeding, (3) weight, (4) health, and (5) price.

In type or form, a good feeder lamb is fairly low-set, compact, deep, and broad, with a straight back and a wide loin. The shoulders are compact, and the rear quarters are fairly plump even when the animal is thin. A good feeder lamb has a strong constitution, as shown by a wide, deep chest and a full heart girth.

Secure feeder lambs that are high grades or crossbreds and that preferably show some of the characteristics of mutton breeds.

Feeder lambs of around 55 to 65 lb. are most suitable for 90-day feeding periods. By gaining about ⅓ lb. per day, which is a good rate of gain, these lambs will weigh around 85 to 95 lb. at the end of that period. Lambs of this weight, if well finished and of good quality, usually bring the top prices on the market.

For a rapid and economical gain, secure lambs that are healthy and vigorous. Lambs of this kind are usually free from parasites. If parasites are suspected, treat as described in Chap. 6.

Secure feeder lambs at a price such that a profit will be possible at the current price of feeds and the expected sale price when the lamb is fat. Make careful estimates that include the initial cost of the lamb, the cost of feeds, and other items of expense as well as the probable selling price (see Chap. 8 in connection with budgeting). Sheep feeders, like beef feeders, give particular attention to margin, which is the difference between the buying price of feeders and the selling price of the finished animals, stated in dollars per hundred pounds. As a general rule, this margin should be at least one dollar per hundred pounds.

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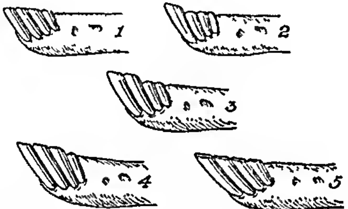

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8. Selecting Goats

Selecting Milk Goats. The breeding of goats for milk production is an industry of some significance in the United States. Milk-goat breeding is based partly on a belief on the part of some persons that goat's milk is to be preferred to cow's milk as a food, especially for babies, and on the characteristic of small size which makes possible the maintenance of one or two milk goats in the back yard of an ordinary town dwelling lot where it would not be possible to maintain even one dairy cow. Goat's milk differs principally from cow's milk in that the fat globules are so

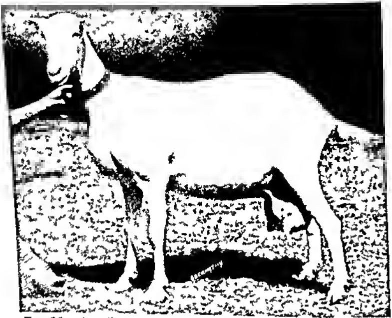


FIG 56 A milk goat (*Mrs Theodore Miller, Springfield, Ill*)

small that they do not separate readily and rise to the top of the milk to form cream. Goat's milk is, therefore, usually used for drinking

There are several pure breeds of milk goats in the United States. The two breeds found in largest numbers and considered to be the heaviest milk-producing breeds are the Saanen, originating in the Saanen Valley of Switzerland, and the Toggenburg, from the Toggenburg Valley of the same country. Saanen goats are white in color, but Toggenburgs vary in color. Bucks and does of both breeds are without horns Many of the goats used for milk production are produced by mating

bucks of the pure breeds to does of the common variety of goats found throughout the country.

In selecting goats of the milk breeds intelligently, the characteristics of the breed in question must be known and selections made to conform as closely as possible to the desired breed characteristics. Bucks of the leading milk breeds should weigh 125 to 175 lb. at maturity, and does from 90 to 125 lb All milk goats are lean and angular in form. The best basis for selection is to look for a goat that appears strong and healthy and depend on milk records as an indication of milk-producing ability. Typical milk production is 1 to 2 qt. per day through a lactation period of 6 to 8 months, however, a few of the best milkers have

FIG 57 An Angora goat (*The Cattleman*)

produced double this amount through lactation periods of 8 to 10 months Milk goats are located throughout all parts of the United States, with heaviest concentration in the Southern and Eastern states.

Selecting Angora Goats. Although similar in form to the common goat and the milk goat, the Angora differs in that it produces a long coat of fine, silky, glossy hair closely resembling wool in character. It is called mohair and is especially desirable for producing heavy plush cloth. Mohair absorbs dye readily and therefore takes on brilliant colors The fleece usually forms in ringlets. A typical 12 months' fleece should

be 12 in long and weigh from 4 to 6 lb The very best Angoras may produce a fleece growth 18 in or more in length and shear as much as 12 to 16 lb

The Angora goat is native to the province of Angora in Turkey Many have been exported from their native home to South Africa and to the United States There are now about 3,000,000 Angoras, counting purebreds and grades, in the United States Sixty-five per cent of them are in Texas Other states in which considerable numbers are to be found are Arizona, New Mexico, California, Washington, Oregon, and Missouri

A sizable Angora goat industry has developed in the United States, principally because the Angora goat will thrive and return an income from certain types of grazing land that are covered largely with brush growth and therefore not suited to grazing by cattle or sheep Goats relish grass just as do sheep or cattle, but they also relish most weeds and buds, small twigs, and the leaves of brush growth As a consequence, goats may be maintained profitably on grazing lands The income from the Angora is secured largely from the fleece, which usually sells at a price somewhat higher per pound than wool The flesh of the goat is called chevon and is used as meat It is strong in flavor and sells at a lower price than lamb

In selecting Angoras for breeding stock, give principal attention to the length, density, and fineness of the fleece Care must be exercised to select goats showing strength of constitution, ruggedness, and size Weights of 125 to 175 lb for mature bucks and 90 to 125 lb for mature does are typical Both bucks and does have horns The face and leg color is white

9 Selecting Horses

Due to the many types of work performed by horses and to the many uses to which they are put under the saddle, numerous breeds have been developed ranging in size from the small Shetland pony weighing not more than 400 lb when mature to the massive draft horse weighing 2,000 lb Horses also differ widely in body form and muscling as the type of work they are expected to do varies from the drawing of a heavy load to the carrying of a rider with greatest comfort and grace, or the running of a mile in the shortest possible time For a discussion of the important considerations in selecting horses, all may be grouped into two general classes or types, the one including the draft- or work horse breeds and

the other the light-horse breeds that are used principally under the saddle.

Choosing Breeds of Draft Horses. In selecting horses, as with other kinds of livestock, one may wish to give some consideration to a choice of breed. Although most work horses are not purebreds, the marks of

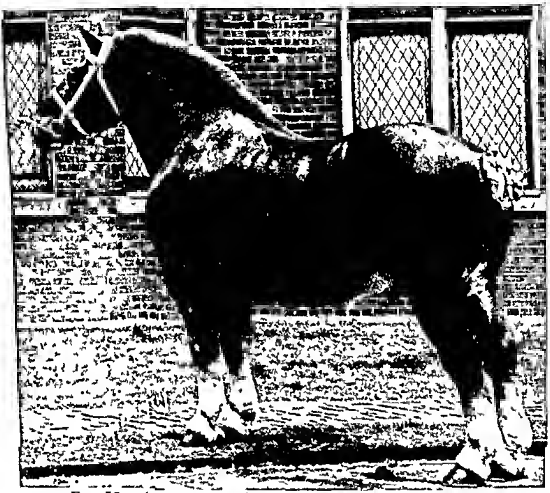


FIG 58 A Belgian stallion (*Photograph by Abernathy*)

some particular breed should be strongly evident, for this indicates that at least one of the parents was "well bred" and quite likely a purebred. In selecting a mare for breeding purposes, and especially when selecting a stallion, the problem "What breed shall I choose?" is important.

Among the draft breeds in the United States, Percherons and Belgians predominate, with the Percheron in first place as to numbers. Some Shires and Clydesdales and occasionally Suffolks are also found. Percherons and Belgians can be readily distinguished from Shires and Clydesdales by the fact that horses of the latter two breeds have long hair, or "feather," on the lower parts of the legs. The Belgians have shorter legs and wider, deeper bodies than the Percherons. The Percheron is usually black or gray, while the Belgian is usually sorrel,

chestnut or red roan In both breeds colors other than those indicated are also found

Clydesdales and Shires in addition to the long hair, or feather on their legs can be identified by their noses which are somewhat plain or Roman in type They are usually bay or brown in color, with white below the knees and hocks (a marking sometimes called white stockings) and a white stripe or blaze the full length of the face The

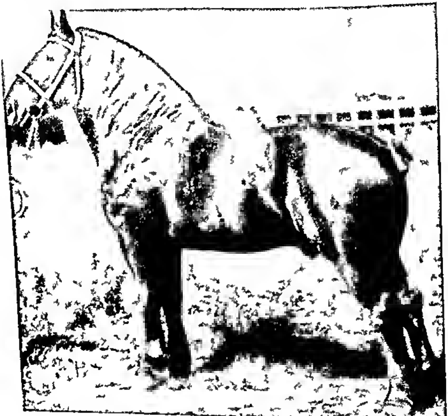


Fig 59 A Percheron stallion (*Photograph by Cook and Gormley*)

Shires are the largest of the draft breeds having massive bodies and large bones while the Clydesdales are the smallest of the four draft breeds already described and show much more quality and refinement of bone In addition to bays and browns grays chestnuts and roans are occasionally seen in both breeds The Suffolk breed which is not frequently found in the United States is the smallest of the draft breeds these animals are compactly built and reddish sorrel in color

The native home of the Percheron is in the former Le Perche district

of France; that of the Clydesdale, in southern Scotland through which the Clyde River flows; that of the Belgian, in Belgium; that of the Shire and Suffolk, in England. The native home of the Shire spreads over several counties. In England, the word "shire" is used similarly to the word "county" in America, and it was probably adopted as a short name for the breed. The Suffolk derives its name from the county of that name in England.

Selecting a Farm Work Horse. In selecting a farm work horse, the primary aim is to secure an animal that will pull medium to heavy loads at a reasonable rate of speed for considerable periods of time.

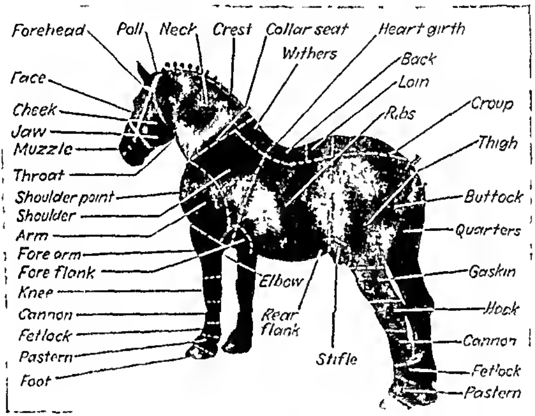


FIG. 60. Names and locations of parts of a horse.

Type or Appearance. In inspecting farm work horses, consider (1) general form and balance, (2) size or weight for age, (3) quality and substance, (4) feet and legs, and (5) action. In judging a horse's appearance, become familiar with the names and locations of parts as shown in Fig. 60.

Since the work horse is the athlete of farm animals, in general form and balance it should give the impression of strength. Well-developed muscles, a short, wide back that is fairly straight from a side view, a deep body, a level croup, and long sloping shoulders all contribute to

this appearance In looking over horses for general form, keep at a distance of several feet in order to see better, and move slowly around the horse to get different views

In general, the greater the size or weight of a draft horse, the greater the pulling ability Weight gives increased traction with the ground, provides greater push on the collar, and is usually associated with strength However, the present tendency in choosing farm work horses is away from extreme weight, since general purpose horses are desired on most farms where tractors perform the heaviest jobs Horses weighing around 1,600 lb or less are in greatest demand on the farms in the Northern states If scales are not available, estimate the weights of draft horses from heart girth measurements using Table 3

The quality and 'substance' of the horse are shown by the hair, hoofs, bone, and joints Too much refinement is not desirable, as a certain amount of substance is required for working effectively In a horse of desired type, the cannon bones are medium sized, smooth, and flat The joints are free from excessive thickness and show a clean-cut appearance The hair is fine, and the hoofs are hard and smooth and free from cracks

The old saying "No feet no horse" serves to emphasize the importance of a good set of feet and legs Secure a horse with legs that are straight when viewed from the sides, front, and rear Carefully examine the hocks, cannons, ankles, pasterns, and feet for defects and unsoundnesses that might affect the usefulness of the horse As noted in a later paragraph and in Chap 6, many of the serious unsoundnesses are found in the feet and legs The pasterns of the draft horse, unlike those of the pig, should be sloping to provide springiness in much the same way that the sprinter runs on his toes in order to absorb the shock and thus give greater springiness to his stride The foot of a good draft horse is large, providing sufficient surface in contact with the ground to give proper traction

In action, the horse preferably shows a straight, long, springy stride Study the action by having the horse walked past you so that you can view it from the front, side, and rear This can be repeated at a trot, as certain weaknesses, if present, will show up more noticeably than at a walk As you observe the stride from the front and rear, note the extent to which the legs are carried straight forward with no tendency to swing the legs out or in or for the feet to strike each other The hocks should pass close together From the side, observe the length and springiness of the stride

TABLE 3. ESTIMATED WEIGHTS OF DRAFT HORSES FROM HEART-GIRTH MEASUREMENTS*

Heart girth, inches	Weight, pounds	Heart girth, inches	Weight, pounds
36	140	59.5	719
36.5	149	60	736
37	158	60.5	752
37.5	166	61	768
38	177	61.5	786
38.5	187	62	803
39	196	62.5	820
39.5	206	63	838
40	216	63.5	856
40.5	226	64	884
41	236	64.5	892
41.5	246	65	911
42	257	65.5	930
42.5	267	66	949
43	278	66.5	969
43.5	289	67	988
44	300	67.5	1,008
44.5	310	68	1,028
45	322	68.5	1,049
45.5	334	69	1,069
46	345	69.5	1,090
46.5	357	70	1,111
47	368	70.5	1,133
47.5	381	71	1,154
48	393	71.5	1,176
48.5	405	72	1,199
49	417	72.5	1,221
49.5	431	73	1,244
50	443	73.5	1,267
50.5	456	74	1,303
51	469	74.5	1,314
51.5	481	75	1,338
52	495	75.5	1,363
52.5	509	76	1,387
53	523	76.5	1,412
53.5	537	77	1,437
54	551	77.5	1,463
54.5	565	78	1,489
55	589	78.5	1,515
55.5	594	79	1,542
56	609	79.5	1,569
56.5	624	80	1,596
57	639	80.5	1,624
57.5	655	81	1,652
58	670	81.5	1,680
58.5	686	82	1,708
59	702		

* L. H. BLAKESLEE, Estimating the Weight of Draft Horses, Agricultural Experiment Station, *Quarterly Bulletin*, Michigan State College, East Lansing, Mich., vol. 27, No. 1, pp. 63-66. For directions for use, see Table 2, page 94

Blemishes and Unsoundnesses Examine the horse carefully to detect any blemishes that may detract from the appearance or any unsoundnesses that may interfere with the ability to do work Many of the serious unsoundnesses are located in the feet and legs Some are located in the regions of the head and shoulders as noted in Fig 194, on page 316 A few of the most serious unsoundnesses that affect the feet and legs are founder, ringbone, and bone spavin These and other abnormalities of the feet and legs are discussed in Chap 6

Examine the shoulder muscles to note any shrinkage caused by an unsoundness known as "sweeny" Note the breathing of the horse to detect any abnormalities which may be present due to heaves, or "broken wind It is especially important to examine the eyes, as defects of sight are a serious handicap to a horse The general behavior of the horse and the carriage of the head in an abnormal fashion may be clues to partial or complete blindness in one or both eyes The use of a flashlight in a darkened stall may help determine the condition, as a horse that is blind will not blink when a bright light is flashed near its eye

Disposition or Temperament A good work horse is gentle and free from vices or habits that interfere with its usefulness By observing the horse in the stall you can often determine whether it is a "halter puller" or a "cribber" Having a horse harnessed may show if it is "collar-shy" or has other undesirable habits

Performance and Pulling Ability Before purchasing a horse, try to observe it when hitched up with another horse and pulling a fairly heavy load Certain undesirable habits such as balkiness, may be revealed in this process Furthermore, it is possible to find out whether the horse pulls steadily and at a fair rate of speed

The actual pulling ability of a horse or a team of horses can be determined accurately with a machine called the "dynamometer" This device is not generally used except in pulling contests The appearance of a horse is often deceptive in determining its ability to pull, as can be shown by use of this device (see Fig 61)

Age The age of a horse is an important factor in determining value A well broken work horse, five to eight years of age, usually commands the highest price As a prospective buyer, keep this in mind and decide whether you wish to pay the price asked for a horse of this age In selecting a horse you should be able to determine its age fairly accurately

With a little instruction and practice, you can learn to tell the approximate age of a horse or mule by inspecting the three pairs of front

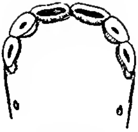
teeth, called "incisors" or "nippers," in the front parts of both the lower and the upper jaws.

The center pairs of "milk teeth," or temporary incisors, upper and lower, appear in the mouth of the young foal at two to four weeks old, the second or intermediate pairs at four to six weeks, and the third

FIG. 61. This team of six-year-olds weighing 5,640 lb. established a world's-record tractive pull of 4,175 lb on a dynamometer. Owner of the team is Lester Smith of Hedrick, Iowa (*R. W. Tenny, Michigan State College*)

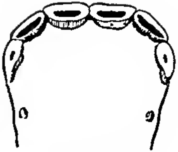
pairs or corner teeth at six to nine months. These temporary milk teeth, or foal teeth, are smaller and shorter than the permanent teeth which appear later. The milk teeth are white in color. The permanent incisor teeth are easily distinguished from the temporary ones in that they are longer and broader and the enamel possesses a characteristic yellowish or cream color in contrast to the milk-white color of the temporary teeth.

The first, or center, pairs of permanent incisor teeth, both upper and

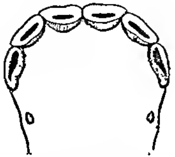


Lower nippers of a three-year-old horse

Side view of teeth of a three-year-old horse

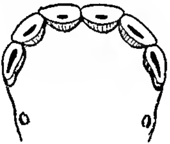


Lower nippers of a four-year-old horse

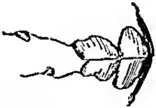


Lower nippers of a five-year-old horse

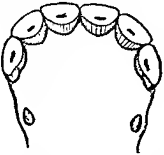
Side view of the teeth of a five-year-old horse



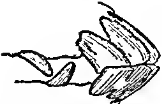
Lower nippers of a six-year-old horse



Side view of the teeth of a six-year-old horse



Lower nippers of an eight-year-old horse



Side view of nippers of an old horse

FIG. 62 Teeth of the horse at various ages (*Cornell Rural School Leaflet, Vol. 22, No. 3*)

lower, begin to push out the temporary ones at about 2½ years of age. They are full-grown and "in wear" at about 3 years. The intermediate temporary incisors are shed at 3½ to 4 years, and the intermediate permanent incisors are in wear at about 4 years. The third, or corner, pair of temporary incisors disappear at 4½ to 5 years, and the permanents are in wear at about 5 years.

When they first appear, the permanent incisor teeth have deep, cup-like depressions in the biting surface, as shown in Fig. 62. These depressions are completely worn away from the center pair in the lower jaw when the horse is six years old, from the intermediate pair at seven years, and from the corner pair at eight years. The cups disappear more slowly from the upper teeth. As horses or mules advance in age, the incisor teeth tend to become longer and narrower at the crown and to meet at a more oblique angle. These changes are shown in Fig. 62. The experienced horseman can estimate with considerable accuracy the correct age of horses above eight years old by the general condition and appearance of the incisor teeth.

Reputation of the Seller. In purchasing a horse, deal with a seller who has a reputation for honesty. He should be willing to guarantee certain items about the horse, and there should be assurance that he will back up his claims. Purchasing a horse from a "fly-by-night" horse dealer is likely to end in disappointment.

Price. As a buyer of a horse, you should be willing to pay a price that is in keeping with its over-all usefulness. If a superior horse is desired, naturally you should expect to pay accordingly.

Selecting a Brood Mare of Draft Type. The brood mare is ordinarily used for work as well as for raising colts. Consequently, what has been said in connection with selecting a work horse also applies in selecting the brood mare of draft type. Additional factors are to be considered in making such a selection.

Type. In general type, a mare purchased for breeding purposes should be outstanding in all of the items discussed for a work horse. In purebreds, give preference to one that is true to type for the breed represented.

Freedom from Unsoundnesses. Freedom from unsoundnesses is especially important in the case of a brood mare, as the weaknesses that lead to these may be transmitted to her offspring. Secure a mare that is free from serious defects in conformation, such as crooked legs, steep pasterns, and steep shoulders.

Pedigree In inspecting the pedigree, look for the names of outstanding individuals among the close up ancestors, particularly parents and grandparents

Prepotency or Transmitting Ability As with other kinds of livestock, seeing the sire and dam and some of the sisters and brothers or half sisters and half brothers of the mare under consideration is helpful in determining the prepotency of this strain or family in transmitting desired characteristics from generation to generation Frequently, a young mare, not as yet fully developed, can be procured at a price attractive to the buyer Information on prepotency is especially important in considering what her future development is likely to be If a mare four years old or older is being considered, it may be possible to see her offspring and thus secure evidence of her ability to transmit desired qualities to her progeny

Other Factors By noting the frequency of foaling after reaching breeding age, you may determine whether the mare has been a regular breeder or not Other factors that should be considered in selecting a brood mare include her disposition, pulling ability, and age, the reputation of the breeder, and the price These were discussed in previous paragraphs in connection with selecting a farm work horse

Selecting a Stallion of Draft Type. Many persons who wish to breed mares do not own the stallion that is used In some cases, the stallion is owned by a horse breeder in the neighborhood, or he may be owned by several farmers cooperatively At any rate, in seeking the services of a stallion consider these factors in determining which stallion to use (1) type or appearance, (2) pedigree, (3) performance, (4) transmitting ability, (5) freedom from unsoundnesses, (6) reputation of the owner

In considering the above factors the comments relative to selecting farm work horses and brood mares as given previously apply Give preference to a stallion that is masculine in appearance and sufficiently large to weigh around 2 000 lb when in breeding condition Smaller stallions are favored by some breeders Investigate the status of the stallion with respect to license, as many states have strict inspection laws, which are to the advantage of the person who wishes to have mares bred

In considering transmitting ability of a stallion, inspect several of his offspring, if possible, and note whether or not they are uniformly good

Breeding guarantees are usually made by reliable owners of stallions

A common type of guarantee is that "the mare will give birth to a foal that can stand and suck"; otherwise, no service fee is collected.

Choosing Breeds of Light Horses. The light horse is used for so many different purposes and so many breeds have been developed that it will not be possible to give each type and breed detailed treatment. A list of the breeds of light horses for which registration was at one time maintained in the United States includes the Thoroughbred, the American Saddle Horse, the American Trotter, the Morgan, the Arabian, the Shetland Pony, the Hackney, the German Coach, the French Coach, the Cleveland Bay, the Welsh Pony, the Hackney Pony, the American Quarter Horse, the Tennessee Walking Horse, the Palomino, the Albino, and the Morocco Spotted Horse. Since there were no horses on the North American continent when Columbus discovered it, all of the light-horse types were imported as pure breeds or developed from foundation stock brought to this country from other countries. The American Saddle Horse, the American Trotter, the Morgan, the American Quarter Horse, the Tennessee Walking Horse, the Palomino, the Albino, and the American Spotted Horse are American productions first recognized as breeds in the United States. All others had been recognized as pure breeds in the country of their origin before importations were made.

During the years preceding the development of the automobile, light horses were used extensively in harness for drawing buggies and light delivery wagons as well as under the saddle. For use in harness, the American Trotter, the Morgan, the German Coach, French Coach, Hackney, and Cleveland Bay were the leading breeds. The Welsh Pony, Hackney Pony, and Shetland Pony were also extensively used in harness. With the coming of the automobile, these light harness breeds have all but disappeared from the farms of the country. A few rather large breeding establishments where American Trotting horses are produced, primarily for harness racing, are still maintained. Some farmers in the South are continuing to breed trotting horses because they are used for farm work and the mares are used to produce mules.

Selecting Light Horses. Because of the many purposes for which light horses are used, the many breeds, and the intermingling of the breeds in their production, no one well-defined standard can be adhered to in selecting them. In selecting a horse to race, his ability to run, trot, or pace a fast mile overbalances all other considerations. In selecting a horse for pleasure riding, sometimes his color and attrac-

tiveness in appearance overbalance all other qualities. Sometimes, especially in selecting a saddle horse for women or children to ride, quietness in disposition and trustworthiness must overbalance all other considerations.

With all kinds of light horses, especially those used in racing, for pleasure riding, particularly in exhibitions, with cow horses used on ranches and jumping horses used in exhibitions and polo ponies, a great deal of skilled training is required so that they will serve their purpose efficiently. This training often represents a large part of the

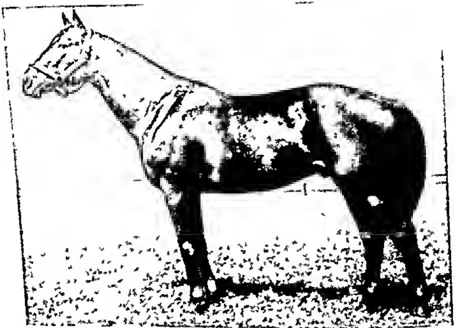


FIG 63 A Thoroughbred stallion. (*Horse and Mule Association of America Photograph by Sutcliffe*)

cost of producing them and must be done by skilled trainers. On this account the more valuable light horses are produced in large breeding establishments where facilities and personnel for this work can be maintained or they are purchased from small breeders at young ages by training establishments.

The Thoroughbred is probably the breed of light horses in which there is greatest interest in the country at the present time. Thoroughbreds are produced almost entirely for racing under the saddle. This is the quality in which this breed has excelled for many years. Although most matings of Thoroughbreds are based on race-track records, the

breed does possess a distinct type The head is of medium size, broad across the forehead with prominent eyes and moderately short, pointed ears. The neck appears long and lean. The body appears deep, medium in width, and muscular. The legs appear flat and strong, the pasterns long and sloping. The feet are of medium size. There is about the entire make-up of the Thoroughbred horse an appearance of quality, stamina, and durability, as though he had been chiseled by a

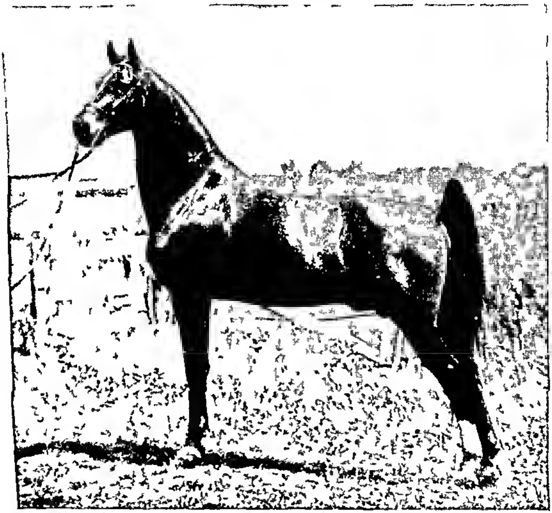


Fig 64 An American Saddle Horse (*Photograph by Smith*)

sculptor. Along with this appearance of durability goes a covering of lean, powerful muscling indicating strength Typical Thoroughbred horses stand 15.2 to 16 2 hands in height and weigh 1,000 to 1,100 lb In order to run fast, a Thoroughbred horse must be strong and sound. Aside from attention to these characteristics, selections for purchase or breeding are based much more upon pedigree and race-track records of close-up ancestors than upon individual appearance. Highly successful race horses may win upwards of $50,000 for winning a single race at any one of several of the larger race meets in the

country each year. Stallions who have demonstrated ability to sire colts that can run fast enough consistently to win races occasionally change ownership at prices running into many thousands of dollars.

Second in number and possibly first in importance among the light breeds is the American Saddle Horse. Although the Thoroughbred and American Saddle Horse are both used under the saddle, they are used for different purposes, and the approved types are quite different in body form. The American Saddle Horse is not required to possess speed at the run. In fact, he is seldom forced into a run, and when he is it is at a slow run or canter rather than a fast run. He has instead

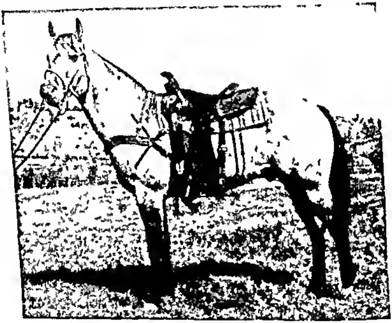


FIG. 65. A Quarter Horse (*The Cattleman*)

been bred for beauty of form and graceful action designed to carry the rider in comfort for recreation rather than for racing The American Saddle Horse must possess above all else a neat, small head, a long neck possessing sufficient fullness and arch to show symmetry and style, and a fullness of muscling throughout the body, which produces a symmetrical, gracefully curved form. The Saddle Horse must stand high and moderately sharp at the withers and show an oblique slope of pastern. He must be clean-cut about the head, throat, and legs and stand straight and strong on legs, pasterns, and feet. The desired height is 15 to 16 hands and desired weight, 1,000 to 1,200 lb.

American Saddle Horses are classified into two groups, designated

as "five-gaited" and "three-gaited." The three-gaited are those that possess the three natural gaits, the walk, the trot, and the canter. The five-gaited must possess two additional gaits, designated as the "slow gait" and the "rack." Seldom is either of the two extra gaits natural to the horse. Both are produced by training. To develop them requires a great deal of patient work by a skilled trainer. This training represents a considerable part of the cost of producing a finished five-gaited horse. Many American Saddle Horses descended from five-

FIG. 66. A Tennessee Walking Horse. (*The Cattleman.*)

gaited parents are unable to develop the two extra gaits satisfactorily and remain three-gaited horses. In both the slow gait and the rack the horse places one foot on the ground at a time. In the slow gait he moves a little faster than at the walk, and in the rack at about the same speed as in a brisk trot. Both gaits are easy on the rider but rather tiring on the horse. The balance of stride and grace of carriage of the head and body at the rack in large measure determine the price at which a five-gaited saddle horse will sell.

Since such horses are often purchased by wealthy persons for pleasure

riding or for exhibiting at shows, they frequently sell at prices up to several thousand dollars

Although the Thoroughbred and American Saddle Horse are the two breeds of light horses existing in largest numbers, at the present

FIG 67 A Palomino (*The Cattleman*)

time there is a great deal of interest in the breeding and use of several additional breeds, principally the Arabian the Tennessee Walking Horse, the Quarter Horse and the Palomino

10 Selecting Mules

The value of a mule is determined entirely by his ability to do work The mule is used in harness and under the pack saddle Mules cannot run or trot fast They do not reproduce, yet as work animals they commonly sell at 15 to 25 per cent higher prices than horses of similar merit The larger mules are well adapted to use on Corn Belt farms Medium-sized mules are especially desired in the Southern states for work in the sugar-cane, cotton and tobacco fields

Some of the highly prized qualities of the mule are his patient dis

position, his ability to withstand heat, his ability to take care of himself in avoiding injury, his inclination to eat only what feed he needs even though more is placed before him, his freedom from digestive disturbance and disease, and the tough, durable, long-wearing quality of his feet and legs. Two advantages frequently claimed for mules over horses are that

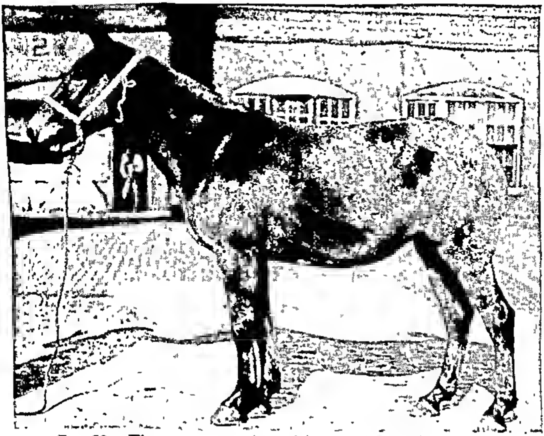


FIG. 68. The cotton mule is used in many parts of the South.

they can pull more than horses of the same size and that they require less feed, but these are erroneous ideas.

Selecting Jacks and Jennets. During the early history of mule production in the United States, the principal need was for jack stock. There were many mares to which the jacks could be mated. Jack stock had been produced extensively for many years in several countries about the western Mediterranean Sea. Many jacks were imported from these countries for use as sires of mules. Some jennets were also imported, and the breeding of jacks and jennets in the United States gradually developed so that now all of the jacks required for mule production are bred in this country.

Through many years of breeding in small areas in their native countries without the introduction of outside blood, a number of strains of jack stock, each having certain distinguishing characteristics, were de-

veloped. After being imported to the United States, little or no attempt was made to keep the several strains distinct. They were instead crossed and intermingled so that most of the imported strains lost their identity. From the mixture of imported animals there has been developed a breeding stock known as the American Jack. In 1888, the American Breeders' Association of Jacks and Jennets was organized, and this association began the registering of breeding stock. In 1908, the Standard Jack and Jennet Association was formed. Later the two were combined

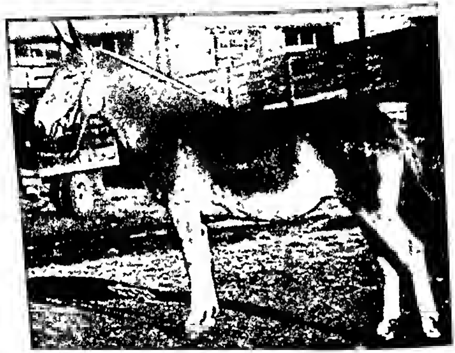


Fig 69. A draft mule.

under the association name, the Standard Jack and Jennet Registry of America.

It has been the aim of the registry association to direct selection of jack and jennet stock toward the production of animals of larger size and more uniform type. Specific measurements are indicated that mature jacks and jennets have to meet before they are registered. Once accepted for registry the offspring of "purebred" jacks and jennets are accepted for registry at young ages without necessarily meeting the measurement requirements.

Although jacks and jennets differ considerably in appearance and proportion of parts from a typical horse, much the same procedure is

followed and the same observations are made in selecting them from appearance Animals of both sexes are slow in movement and sluggish in disposition They do not make satisfactory work animals In breeding jack stock in the United States, bands of jennets are maintained in herds just as cattle are maintained, and no effort is made to work the jennets The breeding of jack stock has always been and will continue to be an enterprise in which only a very few persons will become interested The breeder of these animals must make a highly specialized

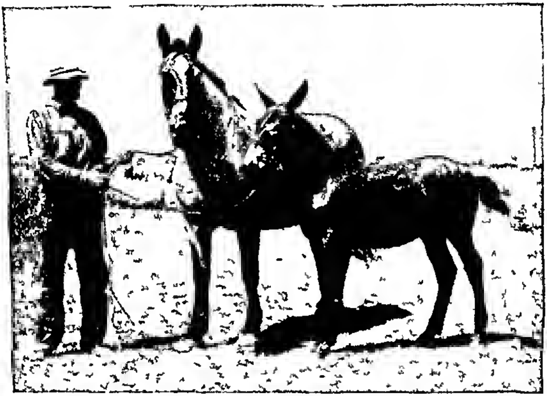


FIG 70 A good type of mare for raising mules shown with her good mule foal (*A M Wettach, Iowa*)

business of it and secure additional information from other sources concerning the selection, care, and management of jacks and jennets

Selecting Mule Mares. The term "mule mare" is commonly applied to brood mares used for raising mules In mule production the mare and the jack should each exert a 50 per cent influence on the kind of mule produced In the Southern states many small mares of mixed or nondescript breeding are used for raising mules The resulting mule foals often seem to resemble the jack more than the mare This is probably because the inheritance carried by the jacks is more firmly fixed through many years of selection than is the case with the mares The experienced mule breeder prefers a mare carrying a mixture of draft-

horse and light horse blood, a mare of draft type body form weighing 1 400 to 1 600 lb with clean, sound straight, heavy boned legs and large tough feet a mare that moves freely with snappy, straight action

To produce a good mule mare requires first, the crossing of the light and heavy horse types Few if any horsemen make a specialty of crossing the horse types for the express purpose of producing mule mares Mule breeders seldom breed the mares they need but rather buy them wherever they can be found Besides the mare carrying a cross of draft and light horse breeding large grade trotting or saddle bred

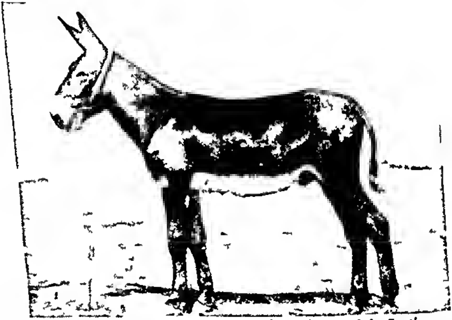


Fig 71 A Mammoth or American Jack (*Photograph by Smith*)

mares and medium-sized grade draft mares make acceptable mule mares Since there are many of these available the mule breeder is generally able to secure fairly satisfactory mule mares though he finds few that are ideal for the purpose Successful mule breeding finally requires the mating of the most suitable jack available to the most suitable mares that can be secured Since the mule colts will be valued only at work stock prices conservatism in the amount of money invested in the breeding stock must be observed

Selecting Work Mules In selecting or buying a mule to work, size is always an important item In the Southern states partly because they are the principal kind available small mules weighing 900 to

1,100 lb. are most common. For Corn Belt use, mules should weigh at least 1,100 lb., and the larger and heavier they are the more useful and valuable they will be. In judging a mule, mainly the same characteristics and qualities are looked for as in judging a work horse. Mules are expected to have long ears set close together and carried erect. They have the thinly haired tail characteristic of the jack. The mane is usually clipped off close to the neck, and the hair of the tail is trimmed with a shears to give it a more attractive characteristic appearance. Careful attention must be directed toward the temperament of a mule to avoid those that have sluggish or stubborn dispositions.

SUPPLEMENTARY ACTIVITIES

1. With others in your class, visit a farm or ranch where livestock of good productive ability is raised. By observing the herds or flocks and through questioning the operator, determine the methods that have been used in selecting animals for breeding purposes. Which of these methods might you use in selecting foundation animals for your livestock program?
2. Whenever the opportunity permits, estimate the weights of individual animals and check your judgment with actual weights as found by the use of scales or by checking with the heart-girth-measurement plan as given in Tables 2 and 3.
3. Arrange with others in your class to visit livestock farms or ranches to place classes of breeding animals in which type and other factors such as pedigree, performance, and prepotency are taken into account. The following are examples:

a. A group of gilts is provided, with the litter mates for each gilt in the group. Information is made available on the number of pigs farrowed and the number raised in each litter, the weights of each litter at 56 days, and possibly other facts. With this information and what can be determined by inspecting the gilts and their litter mates, rank the gilts in the order of their probable value for foundation animals.

b. A group of dairy cows is provided, with information available for each cow on stage of lactation, calving record, and records of production in previous lactation periods. (If purebreds, the pedigrees might also be made available. If purebreds or grades, records of the dams and information about the sires may be available.) Using all such information, plus inspection of the cows themselves, rank them in order of their value for foundation animals.

c. A group of ewe lambs is provided with their dams and, if possible, their sires. Information is provided on the weight of each lamb at a given age, such as 135 days, and on the amount of wool produced by each

dam With this and other information that might be available, the ewe lambs are ranked in the order of their value as foundation animals

d Similar groups of beef heifers or mare colts are provided, together with appropriate information

4 Make a survey of the frequency with which various breeds of the different kinds of livestock appear in your locality Which are most popular? Ask a few farmers why they keep certain breeds How do you account for the greater frequency of certain breeds?

5 Make a special study of your favorite breed Secure information from breed registry associations and other sources on early history, characteristics of its native home and present day blood lines and individuals of prominence Start a collection of materials of this breed

6 Make plans for selecting foundation animals for one or more livestock projects that you expect to start Indicate the factors you will consider in selecting females and males Make visits to farms or ranches where animals are for sale, and make the actual purchases when possible

7 On your home farm or ranch, assist your father whenever animals are sorted for market Learn from him how to select the hogs, cattle, or lambs that are in market condition Secure further experience in grading for the market as explained in connection with marketing in Chap 9

8 Visit fairs and other places where livestock is shown Note the main points of emphasis in judging the classes As classes are being judged make your own placings of these animals and compare them with the official placings finally announced by the judges What features seem to be most emphasized? What factors are not considered that you would consider important if you were selecting a foundation animal?

9 If possible, arrange to see a dynamometer in use in a pulling contest for draft horses or mules What factors seem to account most for the winning teams?

10 Plan a livestock judging contest in which various factors, such as pedigree and performance or production, are taken into account in placing the animals, in addition to appearance or type

11 Learn to estimate the age of sheep and horses from their teeth Whenever opportunity arises, check your estimate with the known age as given by the owner, until you become skillful

3. Feeding Livestock

PROPER feeding is very important in raising livestock successfully. In Chap. 2, emphasis was placed on selecting animals that have the capacity to produce along the desired lines. In Chap. 7, emphasis is placed on breeding for improved efficiency. Unless you feed properly, there is little value in securing good livestock. Someone has expressed the importance of proper feeding by stating that high production must be "bred in and fed out." In this chapter, feeding is discussed under the following activities:

1. Planning a Program for Feeding Livestock
2. Feeding and Fattening Hogs
3. Feeding Dairy Cattle
4. Feeding and Fattening Beef Cattle
5. Feeding and Fattening Sheep
6. Feeding Goats
7. Feeding Horses and Mules

1. Planning a Program for Feeding Livestock

Feed is the biggest single item of expense in livestock production, even when feeding is properly done. In milk production, feed usually constitutes half or more of the total expense. In keeping work horses or raising meat animals, feeds usually comprise 75 per cent or more of the total costs. With feed such a large item of expense, it is evident that no livestock farmer can afford to be careless in his feeding practices (see Fig. 72).

Many farm animals are slow in development and low in production simply because they are improperly fed. Meat animals gain faster and thus reach market at a younger age if they are fed the proper amount and kinds of feeds. Frequently, such animals grade higher when marketed and therefore sell for higher prices.

Proper feeding frequently results in considerable savings in feeds and feed costs. For example, a summary of several experiments shows that, when young pigs, averaging 69 lb. at the start, were fed for market in a dry lot on rations of shelled corn alone, 642 lb. of feed were required for

100 lb of gain and each pig made an average gain of only 0 59 lb per day On rations of tankage and corn, 387 lb of corn and 42 lb of tankage were required for 100 lb of gain, and each pig averaged 1 18 lb of gain per day Thus 42 lb of tankage saved 255 lb of corn, or 100 lb of tankage saved about 607 lb of corn Furthermore, the pigs gained twice as much per day under the better ration With older pigs, averaging 136 lb at the start, 100 lb of tankage saved 538 lb of corn [1]

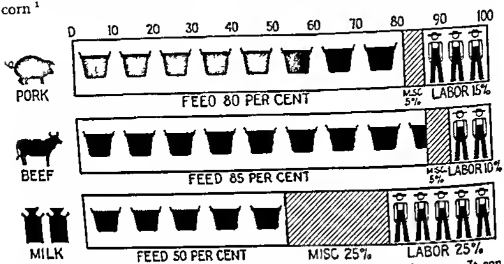


FIG 72 Feed is the biggest single item of expense in livestock production It constitutes 80 to 85 per cent of the total cost of producing pork and beef and about 50 per cent of the cost of producing milk. Through proper feeding much can be done to lower the cost of producing these livestock products (*Morton Salt Company*)

Many dairy cows now producing at a loss or at a small margin of profit would return a fair profit if properly fed A comparison of two herds in Louisiana demonstrates the value of good feeding These two herds were comparable in breeding One herd was provided with better pasture and roughage than the other Over a 2-year period, each cow in the better fed herd averaged 1 gal more of milk per day As shown in Table 4, the cows in the better fed herd averaged 297.5 lb of butterfat, while the cows in the other herd averaged only 140 2 lb, and the corresponding profit over feed costs was $122 88 and $51 84 respectively [2]

[1] F B MORRISON *Feeds and Feeding* pp 851–852 Morrison Publishing Company Ithaca, N Y., 1936

[2] Factors Affecting Profits from Dairy Herds College of Agriculture *Bulletin* 338 Baton Rouge, La, 1942 Note that costs and returns are figured in terms of price levels at that time

FIG 73 Animals of good breeding properly finished for market are the "payoff" in livestock raising The three steers were selected as tops in a vocational agriculture market show on the basis of cost of gains, rate of gains and over all care and management The four hogs averaged 197 lb each at less than 5½ months of age

TABLE 4 THE EFFECTS OF FEEDING ON THE PRODUCTION AND RETURNS IN TWO HERDS OF COMPARABLE BREEDING

Feeding program	Annual production, pounds		Per cent butterfat	Daily milk, pounds	Total feed cost	Return over feed cost
	Milk	Butterfat				
Herd with good pasture and roughage	5,722	297 5	5 2	18.8	$55.92	$122 88
Herd with poor pasture and roughage	3,048	140 2	4 6	10 0	32 16	51.84

Keep in mind, however, that there are limits to what can be accomplished through improved feeding Unless animals have inherited the capacity for high production or for rapid growth, good feeding will not bring about these desired results Methods of breeding for improving the inheritance of farm animals are discussed in Chap. 7.

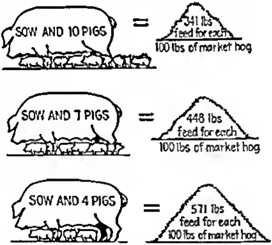


FIG 74 Reduced pig losses at farrowing result in large savings of feed, as shown in this chart For a sow with a litter of 10 pigs, only 341 lb of feed was required for each 100 lb of market hog produced In a litter of 4 pigs, 571 lb of feed was required per 100 lb of gain (*Wallace's Farmer and Iowa Homestead, based on data from Missouri Experiment Station*)

In extreme cases of improper feeding, animals become very unthrifty and may show serious ailments, as discussed in Chap. 6. For example, crooked legs or other evidence of rickets in young animals, goiter in calves or lambs, anemia in little pigs, depraved appetite in cows, and

an ailment called azoturia in horses are abnormal conditions that may develop as the result of faulty feeding.

One of the most serious losses to the livestock farmer is the death of young animals at or soon after birth. Proper feeding of the mother and young helps considerably in reducing this loss.

Utilizing Scientific Methods of Feeding. In order to proceed intelligently in feeding farm animals, the stockman must know (1) how animals use feed, (2) the important nutrients in feeds, (3) the nature of the digestive systems of various kinds of livestock, and (4) factors to consider in selecting feeds for a ration.

Uses of Feeds by Farm Animals. Animals use feed for one or more of several purposes, including (1) maintenance, (2) growth, (3) development of unborn young, and (4) some form of production, such as fat, milk, wool, or work.

In every animal body, a certain amount of feed is used to carry on and support the normal life processes, such as keeping the body warm, repairing tissues, breathing, chewing, digesting food, pumping the blood, and minor movements of the body. The feed used for such purposes is called the "maintenance ration." In addition to feed for maintenance, the growing animal requires feed for growth of muscles, bones, and other tissues. Pregnant animals require feed for the development of the unborn young. Female animals, while suckling their young, require feed for milk production, and dairy cows require feed for this purpose during most of the year. Sheep require feed for producing wool, meat animals for laying on fat, and work horses for pulling loads. In each of these uses of feeds, differing amounts and kinds of feeds are required for supplying the necessary nourishment.

Important Nutrients in Feeds. Certain ingredients of feeds when digested are used in the animal's body for specific purposes. These ingredients are called *nutrients.* The important kinds of nutrients are (1) carbohydrates, (2) fats, (3) proteins, (4) minerals, (5) vitamins, and (6) water.

Carbohydrates include starches, sugars, and fibrous material or cellulose of plants. These materials are used in the production of heat and energy and in certain products such as milk. Carbohydrates make up more than half of any well-balanced ration. When fed in sufficient amounts, carbohydrates are stored as fat in the animal body and thus aid in the fattening process for market animals.

Fats serve much the same purposes as carbohydrates. Most feeds

contain only small amounts of fat, but each unit of fat is about 2¼ times as powerful as carbohydrates for furnishing heat and energy and for building fat in the body.

Proteins are used for building new tissues in the bodies of growing animals and in the repair of worn-out tissues. They are also essential parts of milk and wool. When fed in large amounts, they may be converted into energy or stored as fat, although proteins are not so economical as carbohydrates and fats for these purposes.

Minerals are necessary for the development of bones and teeth and for the production of blood and certain other body fluids and are also

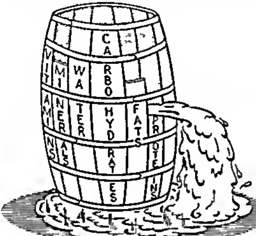


FIG 75 A ration should provide nutrients in the proper proportions for best results in terms of production. An animal will produce no more than the lowest stave in the barrel of feed nutrients If any one nutrient is insufficient, it becomes the limiting factor in production (*Extension Service, Iowa State College*)

used in the production of milk. Calcium and phosphorus are the minerals needed in largest amounts for bones and teeth and in milk production. Iron is needed in building red blood corpuscles, and copper is necessary in small amounts for the body to use iron. While many essential minerals are provided in ordinary feeds, additional amounts are necessary under certain conditions. All animals require common salt for proper health. In some communities, it may be necessary to supply iodine. For this reason, it is good feeding practice to feed iodized salt to all livestock, especially if you live in an area where iodine is known to be deficient, such as in the North Central region and the Great Lakes area. Occasionally, certain minor, or "trace," elements, such as cobalt, are necessary for sheep and cattle

when not present in sufficient amounts in the normal feeds produced in the region. In some instances at least, this situation is due to corresponding deficiencies in the soil in which the plants grow. Phosphorus deficiencies in farm animals in certain localities are caused in a similar manner. Check with the college of agriculture in your state to find out if any special mineral shortages or deficiencies occur in your region. If so, follow the recommendations of the college.

Vitamins are necessary for regulating the body and aid in keeping it in a healthy and vigorous condition. Vitamins A, B, C, D, and E are among those important in animal nutrition. Vitamins A and D are apparently the ones that should concern us most in animal feeding although it is not often that farm animals fail to get enough even of these for normal health. The others are normally present in sufficient amounts in the feeds or are built up within the animal's body.

Vitamin A is present in considerable amounts in green feeds, leafy hay, silage, yellow corn, and certain other feeds. It is needed for normal growth and for developing resistance to certain infections. Vitamin A deficiency is not common in farm animals, except in some cases when roughages of poor quality are fed. Scours may occur in newborn calves when the colostrum (first milk of the fresh cow) is low in vitamin A. This may be the case when the cows get roughages that are low in this vitamin.

Vitamin B is really a group of vitamins; for this reason it is frequently called the "vitamin B complex." Among those included are vitamin B_1, or thiamin; B_2, or riboflavin (sometimes called "vitamin G"); niacin, or nicotinic acid; and vitamin B_{12}. Most members of the vitamin B complex are manufactured by bacteria in the digestive tracts of farm animals other than hogs. Hogs seldom suffer from insufficient amounts, although a few cases have been reported where ailing hogs have improved when fed nicotinic acid. Under some conditions, rations may provide insufficient vitamin B_{12} for brood sows, suckling pigs, and pigs up to 75 lb. Occasionally, scours in young calves may be due to insufficient nicotinic acid; the deficiency may occur before the body starts to manufacture it.

Vitamin C (ascorbic acid) is manufactured in the bodies of farm animals; ordinarily, enough is provided for normal health. Occasionally, newborn calves developing scours respond to the addition of vitamin C.

Vitamin D is necessary for the proper use in the body of phosphorus

and calcium, which are needed for bone and tooth development Improper amounts of vitamin D or insufficient amounts of phosphorus or calcium, or a combined shortage of these may cause rickets Vitamin D is sometimes called the "sunshine vitamin because animals that receive the direct rays of the sun have the power to manufacture their own supply Under normal conditions the farm animals discussed in this book receive enough vitamin D from the effects of the sun or from leafy, sun cured hay Occasionally, pigs fed indoors in winter in cold climates may need extra vitamin D

Vitamin E deficiency does not occur in the feed of farm animals on ordinary rations

From the above it appears that under normal conditions and with good rations farm animals usually secure enough vitamins[2] Only rarely is it necessary to supply vitamins through special forms available on the market Even hogs will usually receive enough of the needed vitamins if they are fed good rations which include supplements from animal sources (such as tankage, fish meal, or milk) and good pasture crops or leafy, sun cured hay

Water in proper amounts is very essential for all kinds of livestock Although succulent feeds such as silage and grass contain a large amount of moisture, additional water is needed Preferably, there should be clean, fresh water available at all times Cows, for example, require large amounts of water, although they prefer to drink small amounts at a time at frequent intervals Each cow not producing milk requires around 12 gal of water per day, and a cow producing 60 lb of milk daily requires 32 gal, or about a barrel of water, each day Water is the cheapest feed that a farmer can provide for the animals he raises

As discussed in this chapter and in Chap 4, good watering devices should be provided for each kind of livestock from which a regular supply of fresh water will be available

Antibiotics in Feeding A recent discovery in feeding swine is the favorable effects from including certain drugs called "antibiotics" in the rations of pigs at certain ages The main effect of these antibiotics is to increase the appetite of the pigs and thereby cause them to eat more feed and to make faster gains than they would from rations which

[2] The above summary is based in part on Huffman and Duncan The Nutritional Deficiencies in Farm Animals on Natural Feeds *Annual Review of Biochemistry* vol 13 pp 467–480 1944

provide none of these materials. The result is that these hogs reach market in less time than hogs fed otherwise good rations without these substances.

The reason why antibiotics are beneficial to hogs is not fully known. One theory is that they act on the intestinal organisms in a manner beneficial to the hog, either by stimulating the desirable organisms or by checking undesirable organisms.

Antibiotics are of doubtful value in rations of ruminants, such as cattle and sheep. However, under some conditions, certain antibiotic feed substances have benefited young calves and increased the gains of

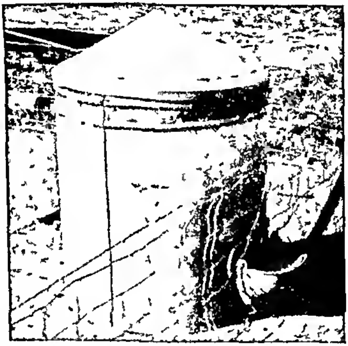


FIG 76 Clean water in ample amounts is essential for all kinds of livestock Illustration shows a good type of automatic waterer for hogs and sheep (*Minnesota Experiment Station*)

beef cattle. Much remains to be learned about the use and effect of antibiotics in livestock feeding. For further information on feeding antibiotics to hogs, see the section of this chapter on feeding hogs.

Digestion of Feeds. Before animals can use the nutrients in the feeds they eat, digestion must take place. The digestive systems of various kinds of farm animals differ, as shown in Fig 77. These differences in the digestive systems call for differences in feeding practices.

The cow and the sheep each have four stomach compartments Such animals have the capacity to handle large quantities of hay and other bulky feeds, known as *roughages.* These animals are sometimes called *ruminants* or cud-chewing animals, because they first swallow their feed

with very little chewing and later bring the food back to their mouths for further chewing

The horse has a comparatively small stomach but can handle considerable roughage. Increased capacity for digesting bulky feeds is possible because of a large caecum, or "blind gut," located at the same places as the appendix of the human being. Furthermore, portions of the large intestine are greatly enlarged, and this aids in the digestion of bulky feeds.

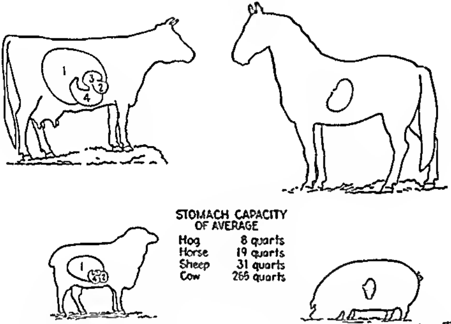


FIG 77. The stomach capacity differs widely in different kinds of animals These differences must be taken into account in successful feeding (*Extension Service, Michigan State College*)

The digestive system of the hog more closely resembles that of the human being than that of either the cow or the horse. Consequently, the pig is best equipped for handling large amounts of concentrated feeds, such as grains. While hogs can consume grass and other roughages, these must comprise smaller proportions of the ration than in the case with the cow or the horse.

Before the animal body absorbs the nutrients in feed, the digestive process changes the nutrients to a soluble form. In this form they are picked up by the blood stream and carried to various parts of the body. The undigested portions of feeds are eliminated from the digestive tract in the form of manure. Certain waste products, resulting from

the use of nutrients in the body tissues, are eliminated in the urine

Selecting Feeds. In selecting feeds for rations for each kind of livestock, consider several factors These include (1) balance of nutrients, (2) cost, (3) bulkiness, (4) effect on animal or product, and (5) likes and dislikes of animals

Provide each kind of livestock with the kinds and amounts of feeds that supply the necessary nutrients Remember that all animals require carbohydrates, proteins, mineral matter, vitamins, and water Some animals require larger amounts of certain of these than other animals For example, young animals need larger amounts of proteins and minerals than mature animals Dairy cows producing milk require larger amounts of protein and minerals than mature work horses Fattening animals need larger amounts of carbohydrates or fats in their rations Thus, each animal requires the proper balance of nutrients in its ration This is discussed further in connection with the feeding of each kind of livestock

Not only is it desirable to select a combination of feeds that furnishes the necessary nutrients, but the feeds selected should be as low in cost as possible Home-grown feeds are usually cheaper than purchased feeds For this reason, raise as much of the feed for your livestock as possible, although you may find it necessary to purchase some feeds high in proteins, as well as feeds high in minerals, including salt In buying such feeds, study the costs of various kinds for sale so that the greatest value can be obtained for the money spent

Cattle and sheep, as previously mentioned, can handle large amounts of feeds that are quite bulky in nature These bulky feeds, such as pasture crops, hay, and silage, all of which contain considerable fiber, are called *roughages* Other animals, such as hogs, require feeds that are fairly low in fiber These feeds, such as grain and tankage, are called *concentrates,* because they provide a large amount of nourishment in proportion to their weight As discussed later in this chapter, dairy cows that are fairly high producers require some concentrates in their rations In fattening beef cattle and lambs for market, some concentrates are usually provided. On the other hand, while hogs can consume some roughages, most of their ration will consist of feeds of the concentrated type, such as corn or other grains Horses at hard work require grain and hay in approximately equal amounts by weight However, idle horses can be fed on rations consisting mostly of hay or other roughages

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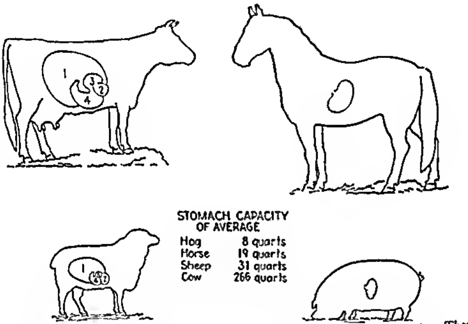

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A careful feeder considers the possible effect of the feed on the animal or product Some feeds such as wild onions, may taint the milk if eaten by cows in sufficient quantities and close to milking time Hogs fed a ration in which soybeans comprise more than 10 per cent may produce carcasses in which the fatty portions are soft and inferior in quality Under certain conditions sheep and cattle bloat when they consume large quantities of green clover or alfalfa Various animals, especially horses and dairy cows, are thrown off feed or have digestive disturbances if too rapid a change is made in the rations fed Spoiled feeds may cause disturbances when fed to horses and other livestock

Fig 78 Self feeders and a concrete feeding floor are desirable for economical feeding of swine (*Successful Farming*)

Good livestock feeders give attention to the feed likes and dislikes of the animals A feed is said to be *palatable* if the animal eats it readily Since cattle feeders and dairy farmers for example try to get their animals to eat large quantities of feed it is desirable to recognize the likes and dislikes of these animals Dry fodder and dry grass are not very palatable whereas corn silage and fresh green grass are well liked To emphasize the importance of selecting feeds that are palatable, it has been said that a good livestock feeder keeps his feed a little better than his animals

Estimating Amounts of Feeds Needed In building a livestock program estimate the amounts of feed that will be required This is im

TABLE 5 APPROXIMATE FEED REQUIREMENTS FOR LIVESTOCK UNDER MICHIGAN CONDITIONS*

Class of livestock	Corn bu	Oats bu	Wheat bu	Protein† supp., lb	Hay ‡ tons	Silage ‡ tons	Other roughage tons	Tillable pasture § acres
Hogs								
Sow and 1 litter to weaning	20.0	3	3	35				0.2
Sow and 2 litters to weaning	25.0	5	5	125				0.2
Boar	20.0	5		35				0.2
Spring pig (30–200 lb.)	12.0			50				0.1
Fall pig (30–200 lb.)	14.0			75				
Feeder pig (100–200 lb.)								
Feeding on pasture	7.0			30				0.1
Feeding in dry lot	8.0			45				
Cattle								
Dairy cow (200 lb. butterfat)	10.0	20		150	2.0	2.5	0.5	2.0
Dairy cow (250 lb. butterfat)	14.0	25		250	2.0	2.5	0.5	2.0
Dairy cow (300 lb. butterfat)	18.0	30		300	2.0	2.5	0.5	2.0
Dairy cow (350 lb. butterfat)	[illegible]	35		350	2.0	2.5	0.5	2.0
Dairy heifer, 2d yr	2.0	3		50	1.0	1.5	0.5	1.0
Dairy heifer, 1st yr	5.0	10		100	1.0	0.5		
Bull	5.0	10		250	1.0	2.0	0.5	
Beef cow	1.0	1		30	0.5	1.5	1.0	2
Beef heifer, 2d yr	5.0	8			0.5	1.5	0.5	1
Beef heifer, 1st yr	4.0	4			0.5	0.5		
Feeder cattle (100 lb. gain)								
Calf	8.5			75	0.1	0.2		
Yearling	10.0			88	0.1	0.3		
2-year-old	12.0			100	0.2	0.5		
Sheep								
Ewe or ram	1.0	1			0.2		0.1	0.2
Sucking lamb to 90 lb.	0.5	1		20	0.02			0.1
Feeder lamb (feeding period)	2.0	1		15	0.06			
Horses								
Work horse (2 yr. and over)	[illegible]	[illegible]			1.5		1.0	2.0
Colts under 2 yr. (average)	5.0	16			1.0		0.5	1.0

* Adapted from Analyzing and Planning the Farm Business, p. 12, Extension Service, Michigan State College, East Lansing, Mich.

† One gallon of skimmed milk may be substituted for 1 lb. of protein supplement for hogs.

‡ Legume hay may be substituted for silage at the rate of 1 ton for each 3 tons of silage for dairy cattle.

§ Pasture requirements vary considerably because of differences in kind of pasture crop, soil, and climate. Hay of poor quality requires an increase in protein supplement. The following number of bushels of different feed crops are equal in feeding value:

10 bu. corn	13 bu. barley	21 bu. oats
9 bu. wheat	11 bu. rye	21 bu. spelt

portant in adapting the livestock program to your farm or ranch, whether or not all the feed can be raised on the farm itself. Also, as a livestock producer, figure feed requirements carefully before deciding what livestock to raise and how many head to raise. You will then be in a better position to determine what feeds must be secured by purchase and the approximate cost of these feeds.

In Table 5 the approximate feed requirements are shown as determined for Michigan conditions In using this table you must make reasonable adjustments depending on the specific rations used, length of pasture season, quality of livestock quality of feed and other factors

2 Feeding and Fattening Hogs

The hog excels other farm animals in the efficiency with which the body converts grains and other concentrated feeds into body tissue The ration is best made up largely of concentrated feeds with only small amounts of roughage, other than pasture in season Well bred, healthy hogs without pasture require about 400 to 425 lb of feed to produce 100 lb of gain from weaning to 200 lb in weight Of the feed required for 100 lb of gain approximately 360 to 385 lb consists of shelled corn or similar grain and 40 lb of high protein feeds The hog is a rapid growing animal, well bred hogs should reach a market weight of 200 to 225 lb in less than 6 months if properly fed and cared for In fact, some successful hog men cause their pigs to reach this weight in 5½ months or less

Corn and other grains such as barley, wheat oats, rye, and sorghum grain, furnish energy and fat producing nutrients in the swine ration Corn is widely used as a fattening feed throughout the United States While high in fat producing nutrients, it is low in protein, minerals and some essential vitamins Yellow corn, however, has considerable vitamin A Wheat, pound for pound is equal or slightly superior to corn in feeding value for hogs Good quality barley, sorghum grain, or rye is about 90 per cent as efficient as corn When oats make up no more than one third of the ration they are approximately equal, pound for pound, to corn These figures are helpful in determining what feeds to purchase at the prices prevailing at the time

Corn does not need to be ground for hogs Usually, wheat, barley, or rye should be ground coarsely Oats may be fed ground or whole

Fish meal, tankage, linseed oil meal and soybean oil meal are some of the common feeds that provide protein With hogs in general, it has been found that protein feed from more than one source is desirable, as this provides a better quality of protein Consequently, mixtures of protein feeds that include some of animal origin and some of plant origin are commonly recommended

A small amount of alfalfa meal is desirable in dry-lot feeding to provide certain vitamins, some essential minerals, and an added source of

protein. Pastures, when available, are desirable for the same reasons. Pigs on good pasture require less protein than pigs in dry lots. Considerable saving of grain is possible on good pasture, owing to the carbohydrates it furnishes, in addition to the other nutrients it provides.

As with other livestock, hogs should have salt. Under some conditions, it is necessary to supply iodine by providing iodized salt, especially to brood sows. Extra calcium and phosphorus are often needed, and little pigs may suffer from a shortage of iron. Methods for supplying these are discussed in this chapter.

See that good clean water is available at all times for pigs. Self-waterers are desirable, preferably provided with heating devices for cold weather to prevent the water from freezing.

Certain *antibiotics* are beneficial in rations for growing-fattening hogs. These materials may increase the rate of gain as much as 30 per cent, or more, during the period from weaning to 75 lb. in weight. They may save up to 10 per cent of the feed required per 100 lb. of gain. Some experiments indicate benefits from including antibiotics in creep rations for suckling pigs and also in rations for pigs from 75 to 125 lb. and even to market weight. Antibiotics appear to be of little or no value in rations for pregnant or milking gilts or sows. Feeding antibiotics to runts and unthrifty pigs often causes them to make normal gains. Also, these substances in pig rations have reduced certain types of scours. The most effective antibiotics in swine rations are aureomycin, bacitracin, procaine penicillin, and terramycin. For further information on feeding these materials, see the sections of this chapter on feeding weanling pigs and feeding pigs from 75 lb. to market.

Feeding the Breeding Herd. Separate gilts for breeding purposes from the fattening pigs before they become extremely fat. Ordinarily, they need not be separated until they are four to five months of age. Since gilts are usually bred for the first time at around eight months of age, a suitable ration must be planned that will bring them up to this age in a thrifty, growing condition and weighing 260 lb. or more. On good pasture, provide protein feeds at the rate of about ¼ lb. per gilt per day; in dry lots, increase this to ⅓ or ½ lb. A good protein mixture, known as the "trio" or "trinity" mixture, consists of two parts tankage, one part of linseed oil meal (or soybean oil meal), and one part of alfalfa meal. This mixture is especially suitable for feeding in dry lots, but the alfalfa meal adds bulk, and thus makes the mixture more suitable for feeding dry in limited amounts in troughs. In addi-

tion, provide sufficient corn or other grain to keep the gilts in good condition For other supplemental mixtures see Tables 6 and 7

About 2 weeks prior to breeding feed a gilt or sow a flushing ration, if she is not already in good, thrifty condition The feeds can be similar to those fed up to this time but should be increased in amount Such a practice is believed to increase the number of pigs per litter, and it may increase the likelihood that the sow or gilt will settle the first time she is bred Sows that have just had their pigs weaned usually come in heat during the first few days after the pigs are removed Since it is desirable to breed them soon there is not much opportunity for flushing However sows that have been properly fed during the nursing period will usually be in fairly good condition for breeding

Feeding the Bred Gilt or Sow During pregnancy, feed the gilt or sow liberally enough to keep her in good condition Keep gilts separate from sows, as their handicap in size will frequently result in the older sows keeping them from securing their proper share of feed

The feed for bred gilts and sows will usually consist primarily of home grown grains, such as corn oats barley, or wheat Ear corn is commonly fed This can be scattered on the ground at some distance from the sleeping quarters to stimulate exercise Many hog raisers like to include some bulky grain such as oats as part of the ration for brood

TABLE 6 TYPES OF SUPPLEMENTAL FORMULAS FOR BRED SOWS AND LACTATING SOWS TO BE FED IN DRY LOT*

Item	A	B	C	D	E
Ingredients pounds					
Alfalfa meal, dehydrated	350	200			400
Alfalfa meal sun-cured			300	400	
Meat and bone scraps	300		100		
Tankage		200	100	300	
Fish meal		100			300
Soybean oil meal	350	350	375	260	260
Dried corn distillers solubles		100			
Dry skim or buttermilk			100		
Ground limestone		20	15	15	20
Steamed bone meal		15	10	12	15
Iodized salt	12	15	12	13	15
Total	1 012	1 000	1 012	1 000	1 010
Approximate analysis					
Protein per cent	40 0	40 5	35 4	36 1	37 9

* G P DEYOE and J L KRIDER, Raising Swine" p 175 McGraw Hill Book Company Inc., New York 1952.

sows. This may be fed whole or ground. In addition, a good protein supplement is needed.

Bred sows or gilts in dry lots require daily about 5 to 6 lb. of concentrates per head. Of this amount, about 1 lb. should consist of a good supplement. For use in dry lot, one of the supplemental mixtures shown in Table 6 is suitable.

Bred sows or gilts on good pasture require daily per head about ⅓ to ½ lb. of a good supplemental mixture. Less grain is needed than in the dry lot. For use on pasture, one of the supplements shown in Table 7 is suitable.

TABLE 7. TYPES OF FORMULAS FOR SUPPLEMENTS FOR SWINE OF ALL AGES ON GOOD PASTURE*

Item	A	B	C	D	E	F
Ingredients, pounds						
Tankage	500					100
Meat and bone scraps		100	500			100
Fish meal				300		100
Soybean oil meal	500	600		300	500	300
Linseed meal		100	500			200
Cottonseed meal or peanut meal		200		400		200
Dried corn distillers' solubles					500	
Ground limestone	30	50		40	60	40
Steamed bone meal		20		40	40	20
Salt	20	20	15	20	25	20
Total	1,050	1,090	1,015	1,100	1,125	1,080
Approximate analysis						
Protein, per cent	50 0	39 9	42 5	44 6	31 6	42 8

* G P DEVOE and J L KRIDER, 'Raising Swine" p 182, McGraw Hill Book Company, Inc , New York, 1952

Gilts should gain about 1 lb. per day during pregnancy and sows about ¾ lb , depending on their condition when bred. Adjust the grain as needed to keep them in smooth, medium condition.

To be on the safe side, feed a simple mineral mixture such as equal parts of steamed bone meal, ground limestone, and salt. Make this available in a box or self-feeder. Use the iodized salt if hairless pigs are likely to appear. It is well to provide extra iodized salt in a separate box or feeder in addition to the mineral mixture. Keep plenty of water available at all times.

Feeding the Boar. Feed the boar similarly to gilts or sows of equal weight. During the breeding season, provide one of the supplemental

mixtures in Table 6 at the rate of about 1 lb per day Provide plenty of opportunity for exercise Feed the boar enough grain to keep him in thrifty condition but not enough to make him fat

Feeding the Sow and Litter Just before farrowing, reduce the sow s ration Substitute bulky, laxative feeds such as wheat bran or oats, for the corn After farrowing, increase the feeds gradually to prevent udder trouble in the sow and scours in the pigs Starting with 3 to 4 lb of feed daily for a 400 lb sow increase the amounts until at the end of 10 days or 2 weeks she is on full feed" which means all she will eat This is desirable since a sow suckling a fairly large litter is one of the hardest working animals on the farm At this time, the

Fig 79 These bred gilts are fed enough to keep them in smooth med um cond t on Some of the feed such as ear corn s fed at a d stance from the sleep ng quarters to st mulate the g lts to exerc se

average 400 lb sow will consume 12 to 15 lb of concentrates daily, including 1 lb of a protein supplement such as shown in Table 6 if in dry lot, or in Table 7 if on pasture

Pigs kept in the farrowing pens may develop anemia due to insufficient iron and copper Prevent this by placing some soil or pieces of sod in the pen for the pigs to root in, secure this material before the ground freezes from a field that has not been used for pigs in recent years, to avoid possible contamination from worm eggs

Many swine feeders are finding it desirable to put the sows and their litters on self feeders as soon as the sows are on full feed (see Fig 80) Supply a supplement such as one of the mixtures in Tables 6 or 7, in one compartment and shelled corn or other available grain in another part of the feeder Barley wheat, or sorghum grains, if used, should

be ground coarsely. Provide a mineral mixture in a special box or in a compartment of the feeder if no minerals are included in the supplement. See that plenty of water is available, preferably in a self-waterer.

Place some grain in a creep for the pigs so they can eat as much as they desire. Also provide in the creep a supplement, such as one of the mixtures in Table 7 if on pasture or in Table 8 if in dry lot.

TABLE 8. TYPES OF FORMULAS FOR PIG SUPPLEMENTS TO BE SELF-FED IN CREEP AND UP TO 75 LB (DRY LOT)*

	A	B	C	D	E
Ingredients, pounds					
Alfalfa meal, dehydrated		200			
Alfalfa meal, sun-cured	300		300	300	300
Tankage......		300		400	
Meat and bone scraps	300		100		
Fish meal.........			100		
Soybean oil meal...	400	200	300		400
Linseed meal or cottonseed meal		200	100		
Dried skim milk or dried buttermilk		100			
Dried whey.			100		
Dried corn distillers' solubles				300	300
Ground limestone.....					15
Steamed bone meal					10
Salt ...	10	10	10	10	15
Irradiated yeast (9,000 I.U. vitamin D per gm.)†		⅛			
Total wt. of mix‡	1,010	1,010⅛	1,010	1,010	1,040
Approximate analysis:					
Protein, per cent	37.5	40.7	34.6	36.7	29.4

* G. P. Deyoe and J. L. Krider, "Raising Swine," p. 185, McGraw-Hill Book Company, Inc., New York, 1952.
† Not needed if animals have sufficient exposure to direct sunlight.
‡ Antibiotic feed supplement may also be added.

Good pasture is desirable for sows and their litters, preferably a rotated pasture on which no pigs were grazed since it was last seeded. To prevent contamination from worm eggs and filth diseases from the old lots, haul the sows and pigs from the central farrowing house to portable houses located in the pasture. If the use of the central house is continued during pasture season, be sure that the connecting lane is cleaned so that it is free from contamination. Some hog raisers prefer to have their sows farrow in houses located in the "clean" pasture. Many raisers rotate their hog pastures so that fresh pasture is available each

year Alfalfa, clover, rape, cowpeas, lespedeza, rye, and field peas are good pasture crops depending on the section of the country

Feeding Pigs from Weaning to 75 Pounds. The period from birth to 75 lb in weight is the most critical period in the pig's life Therefore, after weaning continue to feed a good ration

Preferably, do not wean pigs until they are at least eight weeks of age, as some of the cheapest gains are made when they are nursing the sows Pigs at weaning time should weigh 35 to 40 lb or more For a few days prior to weaning the pigs, keep the sows away from the self-

Fig 80 With the proper feeds and ample feeder space brood sows and their pigs may be fed from the same self feeder (*Minnesota Experiment Station*)

feeders By so doing, the sows decrease their milk flow, but the pigs continue to eat at the self feeders Then separate the sows from the pigs by moving the sows to other quarters and leaving the pigs in their regular surroundings

Supplemental mixtures suitable for pigs on pasture are shown in Table 7 Supplements for pigs in dry lot are shown in Table 8 Provide one of the supplements in a self feeder, and place corn or other suitable grains in a separate compartment of the feeder Ear corn may be provided on a full feed basis with the supplement self fed

If the entire ration is to be fed as a mixture on pasture, mix one of the

supplements in Table 7 with ground grain in sufficient amounts to make a mixture which contains 16 per cent protein. If the entire ration is to be fed as a mixture in dry lot, mix one of the supplements in Table 8 with ground grain in proportions to make a mixture containing about 20 per cent protein.

Antibiotics in the rations of growing-fattening pigs are often profitable on pasture or dry lot. A practical amount of antibiotics is 10 grams per ton of total ration or 30 to 60 grams per ton of supplement. Purchase antibiotics from reliable feed dealers. If antibiotics are pur-

FIG. 81. A creep with proper feeds in a self-feeder provides a place where small pigs may eat without disturbance. (*Bureau of Animal Industry, U.S. Department of Agriculture.*)

chased as a part of commercial supplements, follow the directions of the manufacturers. To get the best results from these substances, use them in rations which are properly balanced with proteins, minerals, and vitamins. Also, provide a good sanitation program, and use good methods of selecting breeding animals.[4]

Feeding Pigs from 75 Pounds to Market. It will usually pay to feed pigs liberally and thus make it possible for them to continue rapid gains until they are ready for market. In fattening pigs for market, the self-feeder can be used to advantage, as shown in Fig. 82. A standard ration consists of shelled corn in one compartment, a protein mixture

[4] Adapted from materials provided by S. W. Terrill, University of Illinois, 1951.

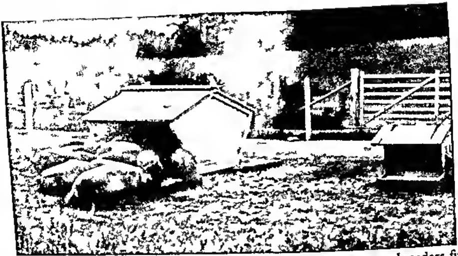

Fig 82 In fattening hogs for market while on pasture many swine breeders find it desirable to provide a large self feeder for corn or other grain and for the protein supplement and a smaller one for a mineral mixture (*Bureau of Animal Industry U.S Department of Agriculture*)

Fig 83 Under favorable weather conditions hogs may harvest corn economically by the hogging-down method A high protein supplemental feed should be provided (*Bureau of Animal Industry U.S Department of Agriculture*)

in another compartment, and a simple mineral mixture as previously described in another See that water is available at all times This ration is effective either in dry lot or on pasture Coarsely ground barley, wheat, or sorghum grains may be substituted for corn A good supplement on dry lot is 2 parts tankage, 1 part soybean oil meal (or

linseed oil meal), and 1 part alfalfa meal. On pasture, the mixture may consist of equal parts of tankage and soybean oil meal. Antibiotics may be added to the ration.

Experiments show that fattening hogs on good pasture make faster gains on less grain and protein feed than in dry-lot feeding. It should be emphasized, however, that it usually pays to feed concentrated feeds liberally while pigs are on pasture, and a protein feed should be included in the ration. A good protein supplement for use on pasture is equal parts of tankage and soybean oil meal (or linseed oil meal).

Many raisers use hogs for "hogging off" corn. This is an economical method of harvesting the crop. However, in the Northern states pigs thus fattened on the new corn crop cannot be marketed before the usual sharp decline in market price occurs in the fall months. In hogging off corn, supply the hogs with a protein mixture self- or hand-fed, similar to the one recommended for dry lot. If the protein feed is self-fed, the pigs may tend to eat more than they need. This can be avoided by mixing with the protein feed increased amounts of bulky, less palatable feed, such as ground oats or ground alfalfa. If hand-fed, feed about ¼ lb. of the protein mixture per pig per day.[5]

3. Feeding Dairy Cattle

Dairy cattle use feed for maintenance, growth, reproduction, and milk secretion. Unless cows are fed the proper amounts and kinds of feeds, they will not have sufficient nutrients for producing milk to their maximum efficiency. Growing heifers must have the proper nutrients for maintenance and for the desirable rate of growth, or their production will be less than it should be when they freshen.

In planning rations for dairy cattle, feeds must be selected that provide sufficient amounts of the necessary nutrients, including carbohydrates, proteins, minerals, vitamins, and water.

Feeding the Milking Herd. As shown in Fig. 84, the proper kinds and amounts of feed are needed for producing milk economically. The problems of feeding the producing herd in winter differ from those in summer feeding.

Winter Feeding. For the winter ration, legume hays should furnish a considerable portion of the roughage. Alfalfa, clover, soybeans, and

[5] For further information on feeding hogs of all ages, see G. P. Deyoe and J. L. Krider, "Raising Swine," Chaps. 4 and 5, McGraw-Hill Book Company, Inc., New York, 1952.

lespedeza are among the best hay crops Hays must be carefully cured to provide the best feed Good quality hay is leafy and greenish in appearance Leafy, sun cured hay furnishes proteins, minerals (especially calcium), and vitamins A and D

Silage provides a palatable roughage for winter feeding Corn silage is low in protein, but on farms where corn can be grown successfully it provides carbohydrates for energy and other purposes economically In some cases, grass crops and legumes are made into silage and used for feeding dairy cattle Legume silage is higher in protein than either grass or corn silage

Where legume hay constitutes the sole roughage, each cow will ordinarily consume 2 to 3 lb daily per 100 lb of live weight Thus, a

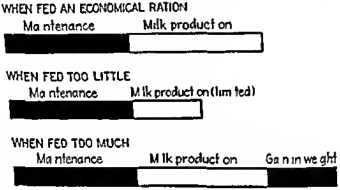

FIG 84 Proper amounts and kinds of feed are necessary for economical milk production (*Extension Service Michigan State College*)

1,000 lb cow will consume 20 to 30 lb per day If silage is included in the ration, allow about 3 lb for each pound of hay replaced Therefore, a 1,000 lb cow will consume 10 to 20 lb of hay and about 30 lb of silage daily Ordinarily, limit the amount of silage so that fairly large amounts of legume hay will be consumed since silage is low in protein and legume hay is an economical source of this nutrient

In the West, where alfalfa hay is exceptionally high in quality and fairly cheap, it may be desirable to use this feed as the entire ration in winter, in spite of lowered production However, for medium to high producing cows, most dairymen prefer to feed some grain This is especially necessary in the Middle West and East where hay is lower in quality owing to less favorable conditions for curing Fairly simple grain mixtures have been found to be as effective as mixtures of a large number of feeds

The amount of high-protein feeds to include in the grain mixture depends on the quantity of protein supplied in the roughage and the productive capacity of cows in the herd. If low-protein hay such as timothy is fed, a grain mixture must be planned to provide increased protein. With alfalfa hay, which is high in protein, provide smaller amounts of protein in the grain mixture. When silage is fed along with some alfalfa hay, the protein content in the grain mixture should be somewhat between, as shown in Table 9. Further details are discussed in the paragraphs that follow.

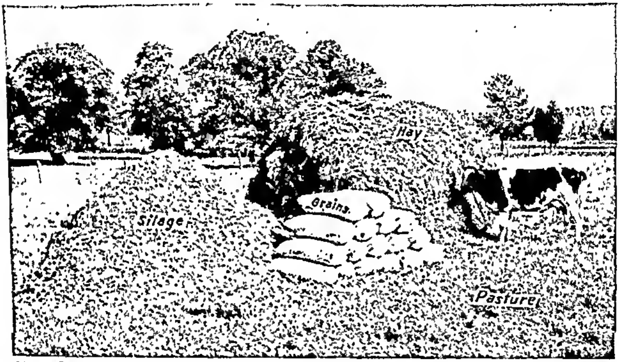

FIG. 85. A dairy cow, if properly fed, eats large amounts of feed. This cow weighing 1,000 lb. produced 7,605 lb. of milk in 1 year. Feed requirements were 6,300 lb. of corn silage, 1,700 lb. of grains and other concentrates, 2,730 lb. of alfalfa hay, and 2 acres of good pasture. (*National Dairy Council.*)

In providing a grain mixture for a herd, it is often desirable to make up one "mix" from which all cows are fed, each cow receiving an amount in proportion to her productive ability. Since high-producing cows require more protein than low-producing ones, put enough high-protein feeds in the mixture to satisfy the requirements for the high producers or at least for the average producers in the herd.

Grain mixtures made up of a few standard feeds and adapted to roughages of different kinds are shown in Table 9. In computing these mixtures, it is assumed that the roughages will be at least of average quality, that if silage is included it will be used at the rate of 3 lb. daily per 100 lb. of live weight of the cow, and that at least 1¼ lb.

of hay per 100 lb. of live weight will be eaten daily in addition to silage.[6] Table 9 shows, for example, that for cows on legume hay the grain mixture should contain about 12 per cent total protein and that a satisfactory mixture consists of 400 lb. of ground corn, 200 lb. of ground oats, and 200 lb. of wheat bran.

TABLE 9. GRAIN MIXTURES HAVING DIFFERENT CONTENTS OF PROTEIN TO BE FED WITH DIFFERENT ROUGHAGES

Roughage	Grain mixture				
	Approximate total protein in grain mixture, per cent	Ground corn, lb.	Ground oats, lb.	Wheat bran, lb.	Cottonseed meal, lb.
Legume hay*	12	400	200	200	
Legume hay and silage or mixed hay†	16	300	200	200	100
Mixed hay and silage	20	200	200	200	200
Nonlegume hay and silage or either	24	100	200	200	300

* If clover, add 100 lb. of cottonseed meal to the mixture.
† One half legume, one half nonlegume.

In Table 9, part or all of the corn in the mixtures may be replaced by barley, wheat, sorghum grains, or hominy feed. Part of the oats may be replaced by some of the same feeds or by corn. Two parts of gluten feed or dried brewers' grain may replace one part of oats and one part of cottonseed meal. Linseed meal, peanut meal, ground soy beans, soybean meal, or fish meal may be substituted for part or all of the cottonseed meal. High grade tankage or meat scraps may be substituted for cottonseed meal at the rate of 2 lb. of tankage for each 3 lb. of cottonseed meal. The quantity of fish meal probably should not exceed 10 per cent of the grain mixture, and the quantity of tankage should not exceed 20 per cent.

Purchase feeds that provide the desired nutrients most economically. If concentrates are needed to increase the protein in a grain mixture, purchase the feed ordinarily that provides this nutrient at the lowest cost per pound. For example, let us assume that linseed meal containing 35 per cent total protein can be purchased for $6 per hundred while a commercial mixture containing 25 per cent total protein can be purchased for $5.50 per hundred. At these prices, each pound of

[6] Food and Life, *U.S. Department of Agriculture Yearbook*, 1939, pp. 592-593.

protein in the commercial mixture would cost 22 cents as compared with 17 for linseed meal; therefore, at these prices, linseed meal would be the cheaper of the two feeds.

Feed the grain mixture to each cow in the herd in proportion to the milk and butterfat she produces. There are several "thumb" rules that are fairly satisfactory guides in feeding the grain mixture. On the assumption that cows are fed all the roughage of good quality they will eat, the following rules are suggested:

1. For high-testing cows of the small breeds (Guernseys and Jerseys), feed 1 lb. of grain mixture daily for each 3 to 3½ lb. of milk produced daily. For lower testing cows of the larger breeds (Holstein, Brown Swiss, and Ayrshire), feed 1 lb. of grain mixture daily for each 3½ to 4 lb. of milk produced daily. (Thus, a Holstein producing 36 lb. of milk per day would get about 9 lb. of grain mixture a day.)

2. Another fairly good rule is to feed to each cow daily 1 lb. of grain mixture for each pound of butterfat produced in a week. Thus, if the milk of the above Holstein tested about 3.5 per cent, she would produce about 9 lb. of butterfat per week and she would get 9 lb. of grain per day.

Either of these rules is reasonably satisfactory for average-producing cows, but may result in too much grain for the low producers and not enough for the really high producers. Consequently, other methods for figuring the amounts of grain mixtures to feed daily to individual cows are coming into use, based on the fact that a cow secures enough nutrients from roughages to meet her body needs and produce milk up to a certain level. Beyond this point, the grain mixture is provided in amounts to supply the nutrients needed for the additional milk produced. The following information is provided for figuring the amount of grain mixture for cows of the various breeds after a certain level of production has been reached:[7]

	Holsteins	Brown Swiss or Ayrshire	Guernsey	Jersey
Feed grain mixture only when daily milk production, pounds, *exceeds*	20	16	14	12
Amount of grain mixture, pounds, for each additional pound of milk over the figure shown directly above	0.41	0.46	0.52	0.56

[7] Food and Life, *U.S. Department of Agriculture Yearbook*, 1939, pp. 592–596.

The estimates for the amounts of production that roughage will support, as shown in the first line in the table above, are most accurate when the roughage consists of good quality legume hay, with or without silage For hay average or below in quality, the figures for the breeds indicated should be 15, 12, 10, and 9 lb , respectively, for the amount of production supported by roughages

As an example of how the preceding method would be applied, we might take the Holstein cow producing 36 lb of milk daily and getting all she will eat of good quality hay and silage As shown above, we can assume that the roughage will supply enough nutrients (over those needed for other purposes) to support 20 lb of milk This leaves 16 lb of milk out of the 36 lb produced daily to be supported by the grain mixture Sixteen times 0 41 (the quantity of grain needed for 1 lb of Holstein milk) equals approximately 7, or the number of pounds of grain mixture she should be fed daily For this level of production, the amount of grain mixture is somewhat less than is found by the other two methods discussed on preceding pages

It will be noted from the preceding table that the amount of grain mixture for each pound of milk produced above the level supported by roughage approximates ½ lb This has led to another rule of thumb, more easily applied, namely Feed each cow 1 lb of grain mixture daily for each 2 lb of milk produced *above* 20 for Holsteins, *above* 16 for Brown Swiss and Ayrshires, *above* 14 for Guernseys, or *above* 12 for Jerseys Everything considered, this is probably the most practical rule to follow

When grains are relatively low in price as compared with roughages, more grain mixture and less roughage can profitably be fed, and vice versa when the opposite is true It is important, however, to feed the grain mixture as indicated so that the high producing cows will receive larger amounts than the lower producing cows

Salt is the chief mineral required by dairy cows They should have free access to loose salt In addition, some dairymen mix 1 lb of salt in each 100 lb of grain mixture Iodized salt is desirable for cows, if calves affected with goiter have been born in the herd Steamed bone meal may be fed to high producing cows if no commercial feeds such as bran or linseed meal (which contain considerable phosphorus) are included in the grain mixture In this case, include the bone meal in the grain mixture at the rate of 1 lb in 100 lb , or mix it with salt half and half and provide it in boxes for the cows to eat as they desire

Provide access to water of moderate temperature at least twice daily. It is preferable to have drinking cups in the barn so that cows have access to water at all times, as illustrated in Fig. 86.

Other factors, in addition to weighing the milk and testing and calculating the amount of butterfat produced, for determining the amount of grain mixture for each cow are the condition of the cow and the relation between the price of grains and the price received for the milk pro-

FIG 86 More milk is produced when drinking cups are provided in the barn so that cows have access to water at all times (*Rural Electrification Administration*)

duced. Extremely thin cows should ordinarily receive increased amounts of grain. When milk prices are relatively high and grain prices proportionately low, you can profitably feed larger amounts of the grain mixture and thus increase the amount of milk produced.

Summer Feeding. Good pasture provides the best feed there is for dairy cows. Proof of this is the fact that the best production is usually secured when cows are turned onto good pasture in the spring. Pasture during part of the year seems to be necessary for cows if they are to continue to produce normal calves at regular intervals. Pasture

crops also provide cows with large quantities of vitamin A, some of which is stored in their bodies as a reserve for the winter season, when a shortage is likely to occur unless exceptionally good roughages are fed. Pasture is also desirable because it is an economical form of feed.

Even when pasture is at its best, high-producing cows need some grain. Otherwise, they will lose flesh, and their production will decline. As long as pasture remains reasonably good, no extra grain is necessary except for the better producers.

When pastures begin to decline, additional nutrients can be provided by feeding silage and hay. Ordinarily, feed these in the evening after

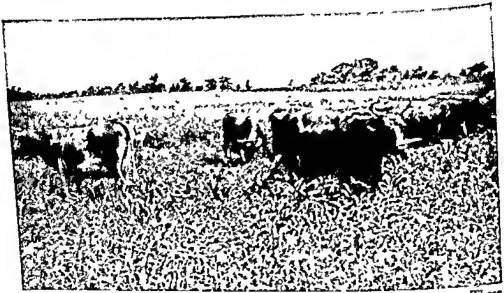

FIG 87 Good pasture is usually the most economical feed for milk cows. These cows are on a Sudan-grass pasture, which is a good pasture crop for the hot summer months in certain parts of the United States (*Bureau of Dairy Industry, U.S. Department of Agriculture*.)

the cows have come from pasture. If fed in the morning, the cows will have less desire to graze.

Grains can be fed as a supplement to poor pasture. In many cases, the recommended amounts for winter feeding should be provided, as explained on page 139.

Alfalfa, alfalfa and brome mixture, lespedeza, Sudan grass, ladino clover, and blue grass are valuable pasture crops. It pays dairymen in various sections to determine the best pasture crops to provide for dairy cows. Alert dairymen provide a succession of pasture crops that furnish abundant feed for as many months as possible during the year.

Figuring a Grain Mixture for a Herd Various combinations of feeds in a grain mixture can be used, provided that the protein content, palatability, and bulkiness are satisfactory Some possible combinations are shown in Table 9, with various modifications indicated on page 138 However, you will wish to figure a grain mixture for your herd that makes use of the feeds you have at hand and can purchase economically Suppose that you are feeding good-quality legume hay and silage as roughages In this case, as shown in Table 9, feed a

Fig 88 Cows grazing on an improved pasture that was given top rating in a New England green pasture contest (*Forsythe, U S Department of Agriculture*)

grain mixture that contains 16 per cent total protein Assume that you have shelled corn, oats, and wheat available and that cottonseed meal is the cheapest source of protein you can buy Consult a table that shows the percentage of total protein in each feed [8] (Corn has 9 3 per cent total protein, wheat has 12 0 per cent, oats has 12 5 per cent, and the cottonseed meal available in this case has 41 0 per cent total protein) After one or two trials with various combinations, one would arrive at figures such as the following

[8] See for example the tables in Food and Life *U S Department of Agriculture Yearbook* 1939, or in F B Morrison, 'Feeds and Feeding Morrison Publishing Company, Ithaca, N Y , 1936, or in the Appendix of this book.

300 lb of ground corn, which contain	27.9 lb of total protein
250 lb of ground wheat, which contain	30.0 lb of total protein
300 lb of ground oats which contain	37.5 lb of total protein
150 lb of cottonseed meal, which contain	61.5 lb of total protein
1,000 lb of the mixture contain	156.9 lb of total protein

$156.9 \div 1{,}000 = 0.1569$, or 15.7 per cent of total protein

Since 15.7 per cent of total protein in the grain mixture approximates the desired 16 per cent, the mixture is satisfactory for the roughage being fed. Feed this mixture to each cow as previously described.

Feeding during the Dry Period and at Freshening. Plan to have each cow dry 6 to 8 weeks each year. During this period, feed her liberally on good pasture or other roughages. In order to get her in good con-

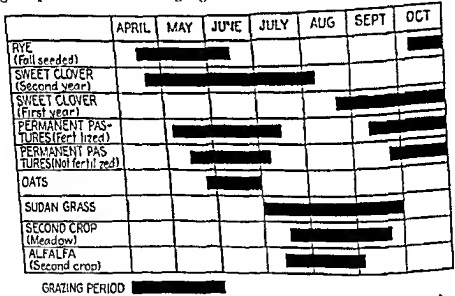

Fig. 89. A good combination of pasture crops provides continuous grazing throughout the growing season. This pasture calendar shows pasture crops suitable for the Middle West and the best grazing period for each. (*Extension Circular 253, Iowa State College.*)

dition before freshening, it may be necessary to feed 2 to 8 lb of grain daily. Eliminate the grain for the week prior to calving. Following calving, provide free access to hay, silage, and water. Increase the grain mixture gradually, as the cow increases in milk production. A satisfactory rate of increase for the grain mixture is usually about ½ lb per day, until the cow's production is as high as seems profitable.

Feeding the Young Calf. Allow the newborn calf to nurse the mother for a couple of days in order to secure the first milk, which is

especially high in protein and certain vitamins and is laxative in nature. After this, teach the calf to drink. Some farmers are using "nipple" pails, as the calves are less inclined to gulp the milk than if they drink directly from a pail. In some cases, nurse cows are used in raising calves. When nurse cows are used, the number of calves nursed by each cow should be in proportion to her production. Hard milkers, low testers, and cows with defective udders can often be used as nurse cows.

Teaching the Calf to Drink Milk. When the calf is about four days old and appears normal and thrifty, take it away from the mother and teach it to drink whole milk from a pail. Teaching the calf to drink from a pail is a task requiring patience. Hold the calf in the corner of the stall, then place two fingers of the left hand in its mouth, and gently force its head into the pail until the nose touches the milk. The calf will usually begin sucking the fingers as soon as they are placed in its mouth and thus begin to suck milk into its mouth between the fingers as soon as the nose and fingers touch the milk. If the calf fails to get the idea at the first trial, you may have to let it go hungry until the next milking time. Hungry calves learn to drink from a pail more quickly than calves that are not hungry. After missing one or two feedings, a calf will work hard to get some milk and in a few days will be drinking without the use of fingers. From then on, the feeding of the milk is a simple task.

Feeding Up To Six Months of Age. After the calf has learned to drink, feed 1 lb. of milk daily for each 10 lb. of live weight of calf. Divide this amount into two or three feeds daily, and feed at regular intervals. Feed milk that is near the normal temperature of milk taken from the cow. After 3 to 4 weeks, change the calf gradually from whole milk to skim milk. Take at least 10 days to make the change. The calf can be weaned from skim milk at six months of age.

Start feeding grain to the calf at ten days to two weeks of age. A grain mixture, such as equal parts of whole corn and whole oats, is desirable until a calf is about three months of age. After that, use the regular grain mixture for the dairy herd. Feeding grain after the calves drink milk helps to discourage them from sucking each other. Calf stanchions or individual pens are desirable to prevent this habit. Provide the calves with good-quality hay at ten days to two weeks of age. Do not feed silage before the calf is four months of age; if fed then,

limit it to 2 or 3 lb daily Provide plenty of clean water at moderate temperatures at all times or at least twice daily

Feeding the Heifer. After six months of age, the heifers can be turned on pasture However, provide limited amounts of hay and grain, in addition to pasture, up to ten months of age After ten to twelve months of age, the calf will develop satisfactorily on good pasture alone, but provide hay and silage if pastures are short During the winter season, feed young heifers liberal amounts of legume hay and limited amounts of silage

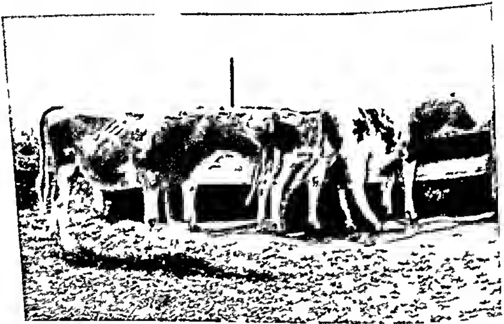

FIG 90 Dairy heifers under one year of age benefit from a light feeding of grain.

For 2 or 3 months prior to calving, feed some grain If the heifers are thin, supply grain even sooner than this Reduce or eliminate the grain a week or two before calving

Provide salt and water at all times of the year

Feeding the Dairy Bull. Feed the bull enough to keep him in medium condition, but not fat. A bull can be maintained largely on high-quality roughages such as legume hay and small amounts of silage. Five to ten pounds of grain mixture daily may be needed to keep him in medium condition A good place to keep a bull in summer is in a small pasture, up to an acre in size, that provides grass as well as exercise Feed grain as needed to maintain him in moderate condition and provide salt and water at all times

4. Feeding and Fattening Beef Cattle

Beef cattle production is carried on under widely differing conditions in the United States. Many beef cattle are raised on the ranges of the West and Southwest, where pasture provides most of the feed throughout the year. Beef cattle are raised on many farms of the Middle West and in other parts of the country. On these farms, pasture furnishes much of the feed during the summer months, with hay, silage, and other roughages fed during the winter months.

Legume hay and grass are used extensively in raising and fattening beef cattle. Silage, corn stover, straw, and certain other roughages are also utilized as parts of rations, especially for breeding herds and steers.

Fig. 91. Range pastures, such as this, provide excellent grazing for beef cattle. (*Mark Nichols, Utah.*)

For the grain portion of the ration, corn is used most frequently. It is fed in a variety of ways, as broken ears, shelled, corn-and-cob meal, and ground shelled corn. Where hogs follow the steers, grinding is not necessary. Another grain suitable for beef cattle is wheat, which, pound for pound, is slightly superior to shelled corn. Barley and sorghum grains are about equal to corn. These grains are usually improved by coarse grinding.

Among feeds high in protein is cottonseed meal, or "cake." It is widely used, especially in the Southern and Southwestern regions. Lin-

seed meal and soybean meal are among the other feeds high in protein that are used extensively.

Salt is the chief mineral that needs to be supplied to beef cattle on most rations. Make it available to them at all times. Use iodized salt for the breeding herd if calves with goiter have been born in the herd. If beef cattle are wintered on nonlegume roughages, it is well to supply some calcium. Some phosphorus may also be desirable. These minerals can be supplied through a mineral mixture of equal parts salt, ground limestone, and steamed bone meal and made avail-

FIG 92 Plenty of water should be provided for beef cattle. In farm pastures or on the range it is sometimes desirable to construct dams in ravines, thus providing artificial ponds which may serve as a temporary water supply. (*A M Wettach, Iowa*)

able at all times. If legume hay is fed, the limestone can be eliminated from the mineral mixture.

Feeding the Breeding Herd. Pasture crops during the summer months and such roughages as legume hay and silage in winter form the foundation for the rations of beef breeding herds. In some areas, pasture provides feed for most or all of the year.

Feeding in Winter. Cows not suckling calves can be wintered largely or entirely on roughages if they enter the winter in good condition. On the range, pastures are grazed during most or all of the year.

Where beef cattle are wintered without pasture, as is true in most

of the Middle West, legume hay and other roughages are used extensively. The following rations are suitable, per 1,000 lb. of live weight, for the breeding herd in winter:

1. Corn or sorghum silage, 30 to 40 lb.; legume hay, 6 to 8 lb.
2. Corn or sorghum silage, 25 to 35 lb; straw or stover or nonlegume hay, 10 to 15 lb.; protein concentrate such as cottonseed meal, 1 lb.
3. Legume hay, 4 to 8 lb.; silage, 15 to 20 lb.; straw, 10 lb.
4. Legume hay or mixed hay of good quality, 16 to 20 lb.
5. Beet pulp, 40 lb.; legume hay, 5 lb.; straw, 10 lb.

If cows are fed largely on nonlegume hay, it is well to provide a mineral mixture as suggested on page 148. Provide salt in addition.

On the range, hay is frequently fed to the breeding herd during the winter season. In the South and West, cottonseed cake is often used to supplement the winter pasture, especially when weather conditions are severe or pasture is insufficient. It is scattered on the ground usually at the rate of 1 or 2 lb. per head daily, although amounts of 4 to 6 lb. per cow are sometimes fed.

Feeding in Summer. Beef cows that calve in the spring after the pasture season starts require no feed other than good pasture until fall or winter. Good bluegrass or other native grasses provide satisfactory pasturage for most or all of the grazing season. Alfalfa, alfalfa and brome, and lespedeza are valuable crops for pasture in certain areas. Silage, hay, or grains are suitable for supplementing poor pasture.

On the range, wise grazing practices are especially important in keeping the breeding herd and young cattle in thrifty condition. The number of cattle should be adjusted to the carrying capacity of the range. In seasons of below-normal rainfall, the number of cattle should be reduced sufficiently to prevent injury to the grasses by overgrazing and unthriftiness in the animals from insufficient feed.

Feeding Heifers. During the months of suckling cows on good pasture, little or no extra feed for the heifers is necessary, although some cattlemen provide a creep for both heifers and bull calves or steers, as discussed under raising baby beef cattle on page 152. If the nursing period comes in winter, give some grain to the calves. One method is to provide grain in a creep, beginning at one month of age; this can consist of such grains as corn and oats, ground or whole.

During the period of 6 to 12 months after weaning, if the heifers

are barn fed, provide all the legume hay or mixed hay they will eat Silage up to 10 lb per day together with legume hay also makes a good ration If little or no legume hay is fed or if the roughage is poor in quality, feed 1 lb daily of a high-protein concentrate, such as linseed meal, per animal If grain is necessary, feed around 3 to 4 lb daily of such grains as corn, wheat, grain sorghum, oats, or barley.

In wintering heifer calves on the range, around ½ lb of cottonseed cake per head daily is desirable

Fig 93 Good legume-grass pasture provides ideal food for a beef herd (*Harvey S Woods, Illinois*)

For the barn feeding of yearling heifers, straight legume hay in ample amounts (about 15 to 20 lb per head daily) makes a good ration Other suitable rations are

1. Legume hay, 5 lb, straw or stover, 5 lb, silage, 10 lb, grain, 3 lb cottonseed or linseed meal, 1 lb
2. Mixed hay, 10 lb, silage, 15 lb, cottonseed or linseed meal, 1 lb.
3. Grass hay, 12 lb, grain, 3 lb, cottonseed or linseed meal, 1 5 lb

In wintering yearling heifers on the range, it is desirable to feed about 1 lb of cottonseed cake per day

Feeding Bulls Bulls on the range should be provided with some hay and about 6 lb of grain daily For barn feeding beef bulls, obtain suggestions from those given for dairy bulls on page 146.

Fattening Beef Cattle. Farmers who maintain beef breeding herds usually plan to raise their own calves for feeding. Where ample pasture

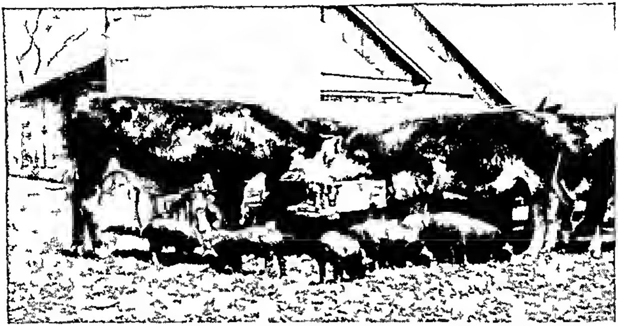

FIG 94 These baby beef steers are nearing the proper condition for market Hogs in the feed lot salvage the feed wasted by the cattle (*A M Wettach Iowa*)

FIG 95 Suitable facilities for fattening cattle Note the convenient arrangement for feeding hay the feed bunks for feeding grain and silage the well drained lot and the cattle shed (*Minnesota Experiment Station*)

and other roughages are available for a breeding herd, this is usually an economical procedure

Many feeders of beef cattle, however, buy their animals for feeding Most of these cattle are produced on the range, where pastures are plentiful for breeding herds but little grain is available for fattening Much of this fattening is done in the Corn Belt, where corn and other grains for fattening are plentiful

Fattening Calves for Baby Beef Many farmers who maintain a beef breeding herd plan to market the offspring as baby beef Such animals are marketed at twelve to eighteen months of age and at weights of 700 to 1,100 lb In order to bring high prices at this age calves must be of good type, they must be fed well from early calfhood and they must grade from good to prime when marketed Many farmers provide creeps for calves on the pasture, where they secure such feeds as shelled corn or other grains A mixture of eight parts shelled corn and one part cottonseed cake has also given good results* The calves are put in a feed lot in the fall where they are fed rations that usually include legume hay silage protein concentrate and grain Some suggested rations for baby beef calves on full feed weighing around 600 lb are

1 Silage 10 lb legume hay 2 to 4 lb shelled corn or other grain 10 to 12 lb high protein feed 1 5 lb
2 Alfalfa hay (good quality) 5 to 7 lb shelled corn or other grain 12 to 16 lb
3 Mixed hay or low quality legume hay 4 to 5 lb, shelled corn or other grain 11 to 15 lb high protein feed 1 5 to 2 0 lb

For all rations salt should be available at all times as well as ample supplies of water

Fattening Yearlings and Older Beef Cattle In fattening yearling steers extensive use can be made of roughages in the form of pasture crops hay or silage Steers purchased in the fall can be fed during the winter on a ration consisting of 35 to 40 lb of silage and 4 to 5 lb of legume hay Other roughages such as fodder can be used along with good legume hay Where the ration consists largely of nonlegume roughages supply about a pound of protein supplement daily per animal Good legume hay alone should result in satisfactory gains

There are two common methods of finishing off beef animals (1) fattening in the dry lot and (2) fattening on grass

When fattened in the dry lot the cattle are usually kept on good pasture up to midseason and then full fed for 3 to 4 months Some possible rations for 900 lb fattening cattle on full feed in dry lot are

1 Silage 25 lb legume hay 4 lb shelled corn or other grain 14 lb
2 Legume hay 10 lb shelled corn or other grain 15 lb

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3. Mixed hay, 10 lb ; shelled corn or other grain, 14 lb.; high-protein feed, 1 lb.

Using Pasture in Fattening Cattle. In recent years, there has been a trend toward increased use of pasture in fattening cattle. Usually, small amounts of grain and other concentrated feeds are fed during part of the period. In making maximum use of pasture, a lengthened period is required for getting beef cattle to market. Cattle fattened on pasture will carry less finish than those fed in dry lot, and they will usually bring lower prices on the market. However, the cost of

FIG 96 Arrangement for saving labor in large feeding operations Self-unloading trucks are driven along the alley in front of feed bunks

gains is decreased, and this frequently offsets the disadvantages. Increased land in good pasture fits into conservation farming. By using good varieties of grass and legumes and proper methods of fertilization, the carrying capacity of many pastures can be increased greatly.

Any one of several systems may be followed in making extensive use of pasture in fattening beef cattle for the market. These include the following:

1. Fattening on pasture alone, with no concentrates
2. Using small amounts of concentrates throughout the pasture period
3. Using liberal amounts of concentrates throughout the pasture period

4 Feeding large or limited amounts of concentrates during the latter part of the pasture period
5 Feeding in dry lot for 2 months or more at the end of the pasture period

The method to use depends on such factors as the grade and age of cattle being fattened, price of feeds other than pasture, quality of pasture, and market prices of cattle In many cases, it pays to feed some concentrates during at least the latter part of the period on pasture or to finish in dry lot on a full feed for a period of 2 or more months In using limited amounts of grain on pasture, as little as 10 to 15 bu of corn per head during the feeding period, or similar amounts of grain sorghum, have given favorable results More grain is needed to produce cattle which sell in the high grades Under some conditions on pasture, it pays to feed up to 1 lb of protein supplement per head per day in addition to grain

Since cattle on pasture are usually not marketed until they are two years old or more, winter feeding is required in Northern states For this purpose, use good roughages, such as legume hay and corn or grass silage If little or no legume hay is provided, feed 1 lb or more of protein supplement, such as linseed, cottonseed, or soybean oil meal Even in areas where winter grazing is normally possible, reserves of hay or other roughages should be provided for use during emergency periods of droughts and severe winter weather Pasture and other roughages should be high in quality and sufficient in quantity to maintain gains of 1 lb or more per day

5 Feeding and Fattening Sheep

In feeding sheep, roughages such as good pasture and legume hay can be utilized in considerable quantities Silage in limited quantities has a place, as have other low protein roughages such as stover or fodder

For grains, corn is the chief low protein concentrate available in many parts of the Middle West In various parts of the country, wheat is also used extensively in years when prices are favorable for its use in feeding livestock Pound for pound, it is slightly superior to corn Barley, oats, and sorghum grains are also used, they are about equal to corn, pound for pound Grinding grains for sheep is not often necessary, except for very young lambs and ewes so old that their teeth are poor

For protein concentrates, linseed oil meal, cottonseed meal or cake, and soybean oil meal are extensively used. Where good-quality legume hays are supplied in plentiful quantities, high-protein concentrates are usually unnecessary for breeding flocks or for fattening lambs, as discussed in later portions of this chapter.

Provide plenty of salt at all times. Supply clean, fresh water in ample quantities.

Feeding the Breeding Flock. For the breeding flock on the farm, good pastures will provide most of the necessary feed during the months when pastures are suitable for grazing. Legume hay of good quality

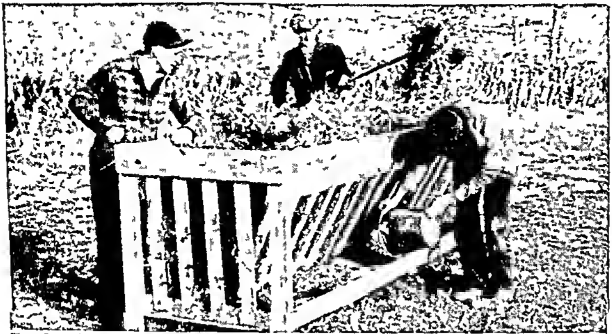

FIG 97. Kentucky boys placing legume hay and grain in a combination hayrack and grain feeder for sheep This rack was constructed as a part of their work in vocational agriculture (*Watson Armstrong, Kentucky*)

provides the main part of the ration on many farms during the remainder of the year.

Feeding at Breeding Time. Some special feeding is desirable for a period starting 2 to 3 weeks before the desired date of breeding the ewes. At this time, a ration known as a "flushing ration" seems to increase the percentage of twins, especially if ewes come up to the breeding season in a thin condition. Provide such a ration by turning the ewes onto a fresh, green pasture or by feeding a light grain ration in addition to the feeds regularly available. About ½ lb. of oats or corn per ewe per day or the same amount of a mixture of corn and oats makes a suitable ration for this purpose, in addition to pasture.

Feeding Pregnant Ewes During the early part of the pregnancy period, plenty of good roughage provides sufficient nutrients, unless the ewes are unusually thin The following are some suitable rations for ewes weighing around 120 lb

1 Silage, 2 to 3 lb , legume hay, 2 to 3 lb
2 Good quality legume hay or mixed hay containing 50 per cent legumes, 3 to 5 lb
3 Corn fodder or stover or straw, 2 to 3 lb , legume hay, 2 to 3 lb

Feed part of these roughages at a distance from the sleeping quarters so that exercise is obtained by the ewes

For a period of 4 to 6 weeks before lambing, add grain to the ration of the farm flock of breeding ewes Start the grain earlier if the ewes are thin Feed around ½ lb per ewe per day of oats, corn, sorghum grain, or other grains or a mixture of grains If the roughage is of poor quality, feed some high protein feed, such as linseed oil meal, cottonseed cake, or soybean oil meal, in addition to grain Around ⅒ lb per ewe per day is usually sufficient

A flock of breeding ewes wintered on the range should have some roughages, preferably in the form of legume hay, in addition to pasturage, in periods of poor grazing due to storms or short grass Some grain for a period prior to lambing is also desirable as with a farm flock

A good sheepman will periodically examine his ewes to find out if they are coming up to lambing in a thrifty but not fat condition By feeling the ewes along the region of their backs, an experienced person can determine the degree of fleshing and decide whether the amounts of grain fed should be increased or decreased

Make salt available to the feeding flock at all times Use the iodized form if goiter has appeared in lambs during previous seasons Where legume hay is of poor quality or is not available, it may be well to feed ground limestone at the rate of ¼ oz per ewe daily or to provide a mineral mixture as described for beef cattle Provide plenty of fresh water

Feeding the Ewe and Lamb Following lambing, keep the ewe and her lamb or lambs together in a special lambing pen for 2 to 4 days Feed the ewe legume hay, and provide plenty of water After 2 or 3 days, add a small amount of grain, and gradually increase this to 1 lb per ewe per day After a few days in separate pens with their lambs, several ewes with lambs can be placed together Some sheepmen prefer to keep the ewes with twin lambs in a group separated from those with

only one lamb each, so that larger amounts of grain can be fed to the ewes suckling twins.

After the ewes and their lambs are placed on pasture, no extra feeding of the ewes is necessary if the pasture crops are good.

Feeding Orphan Lambs. In even a small flock of ewes there are usually a few orphan lambs. These may be lambs from ewes that have died because of difficulty in lambing, ewes failing to produce milk, or ewes not having enough milk to feed two lambs. Occasionally, such lambs are from ewes having triplets. Care for as many of the orphan lambs as possible by getting them to nurse foster mothers. The foster mother may be a ewe that produced only one lamb but is producing milk enough to nurse two, or a ewe whose own lamb died. Patience is needed to persuade a ewe to accept and nurse a strange lamb. It sometimes helps to tie the ewe, milk a little milk from her udder over the head and body of the strange lamb, allow her to smell it, and then hold her while the lamb nurses the first few times. Occasionally, a ewe will not accept a strange lamb, and the attempts to get her to do so must be given up.

Although it is a tedious job, orphan lambs can be raised with considerable success by feeding them on cow's milk from a bottle and nipple. Give a young lamb less than a day old 1 to 2 oz. of whole, fresh milk about every 2 hr. If the milk is cold, warm it to between 90 and 100°F. just before feeding. At one week old, feed 3 to 4 oz. of milk every 3 hr. At two to three weeks old a young lamb will begin to eat a little grain and hay, and the whole milk may be replaced by skim milk. At one month old, milk feedings may be reduced to three a day and a pint of milk or a little more may be given at a feed. Keep the bottle and nipple clean.

Feeding Rams. Feed rams similarly to ewes, but allow larger amounts of roughages. Except for the breeding season, when some grain should be fed, the ration can consist of good-quality roughage.

Fattening Lambs. Lambs in farm flocks should be well fed from the start. At an early age, provide them with grain and hay in a lamb creep, where they can eat at will. Lambs will start to eat after about two weeks of age. Half corn and half oats, ground coarsely, make a good mixture. Another suitable mixture consists of 20 lb. of cracked corn, 20 lb. of coarsely ground oats, 10 lb. of wheat bran, and 10 lb. of linseed, cottonseed, or soybean oil meal. For the first few weeks, grains for lambs should be coarsely ground, as stated above; after that, grinding is unnecessary.

Fig 98 Lambs should be provided at an early age with a creep where they can eat grain and a good-quality hay away from their mothers (*Minnesota Experiment Station*)

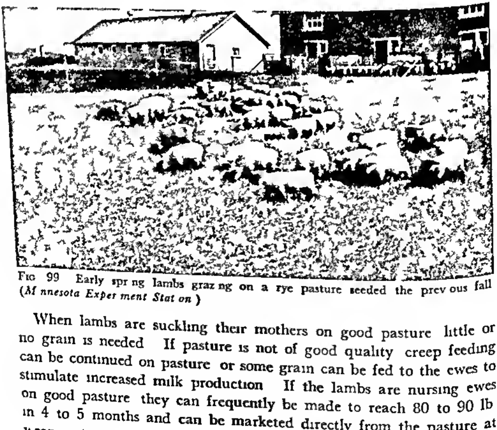

Fig 99 Early spring lambs grazing on a rye pasture seeded the previous fall (*Minnesota Experiment Station*)

When lambs are suckling their mothers on good pasture little or no grain is needed If pasture is not of good quality creep feeding can be continued on pasture or some grain can be fed to the ewes to stimulate increased milk production If the lambs are nursing ewes on good pasture they can frequently be made to reach 80 to 90 lb in 4 to 5 months and can be marketed directly from the pasture at weaning time

Fattening Feeder Lambs. In range production of sheep, the lambs are frequently sold at 55 to 65 lb. in weight as feeder lambs. Many of these lambs are fed by Middle Western lamb feeders for a period of around 90 days, and during this time they gain about 30 lb. if properly fed.

When lambs that have been shipped are first brought to the lot for fattening, start them carefully on feed to prevent possible losses. Some feeders turn the lambs on stubble fields or feed dry roughage at the start of the feeding period. They are then given small amounts of grain. Around $\frac{1}{10}$ to $\frac{2}{10}$ lb. of grain per head per day is sufficient at the beginning. Some bulky grain like oats is especially good at the start, or the grain can be mixed with ground hay. Gradually, introduce other grains, such as barley, shelled corn, or grain sorghum, and increase up to 1 lb. or more per day by the end of 3 to 4 weeks. Some good fattening rations for lambs on full feed weighing around 70 lb. are given below:

1. Shelled corn, 1.25 lb.; legume hay, 1.5 lb.; linseed meal, 0 15 lb.
2. Shelled corn or other grain, 1.25 lb.; cottonseed meal, 0 15 lb.; silage, 1 lb.; legume hay, 1 lb.
3. Shelled corn, 1 lb.; whole oats, 0.5 lb.; linseed oil meal, 0.1 lb.; legume hay, 1.5 lb.
4. Whole grain, 1.3 lb.; good-quality legume hay, 1.5 to 2 lb.

A high-protein feed in the ration is usually unprofitable if good-quality legume hay is fed.

Considerable skill must be used in fattening lambs, or high death losses will occur. Overeating on grains is one of the chief causes of death. To prevent this, feed lambs carefully at the start of the feeding period. During the feeding period, it is a good plan to feed the lambs considerable hay each morning before feeding grain. Some feeders prefer to mix the grain in ground form with ground or chopped hay to prevent overeating. Considerable success has been met with self-feeding these mixtures of chopped hay and cracked grain throughout the feeding period. Such a plan prevents bolting of the feed and resultant overeating. For the first 10 days of the feeding period, feed a mixture of two parts of chopped hay to one part of cracked corn or other grain. During the second 10 days, a satisfactory mixture consists of equal parts by weight of chopped hay and cracked grain. As the feeding period progresses, the proportion can be changed to three

parts of grain to two of hay and, near the end, to two parts of grain and one of hay. Provide additional hay in a rack.

As with feeding steers, commercial lamb feeding is a highly specialized business Careful figuring is necessary in order to buy wisely

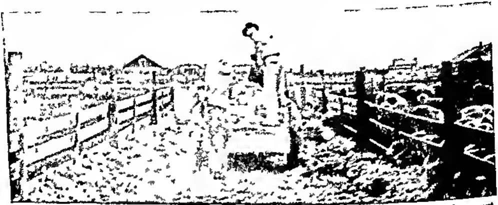

Fig. 100. Eight boys studying vocational agriculture at Hardin, Mont, had a partnership project of fattening 465 lambs Here two of them are shown feeding wet beet pulp (*W. S. Cowley, Montana*)

and estimate the necessary margin between the cost price per hundredweight and the selling price per hundredweight if a profit is to be expected from the feeding operations, as discussed in Chap. 2.

6. Feeding Goats

The feed requirements of goats are similar to those of sheep. However, goats are browsers by nature and are fond of leaves and twigs, as well as good pasture.

Feeding Milk Goats. Does giving milk may secure much of their ration from grass during the pasture season. During the winter, provide good-quality legume hay. Provide some grain throughout the year. One good grain mixture is 100 lb. corn, 100 lb. oats, 50 lb. wheat bran, and 25 lb. of linseed oil meal Feed 1 to 2 lb. of this mixture per day to each doe during the winter, depending on the amount of milk she gives. On good pasture, 1 lb. of grain per day per doe is usually enough. Heavy milkers may need more grain than the amounts indicated.

Feeding Angora Goats. Many of the goats in the United States are Angoras. These are concentrated primarily in Texas and a few other states. These goats on the range secure most of their feed in the form of browse and grass. During the winter, they may need additional feed in the form of hay and ¼ to ½ lb. of grain per head per

day. If nonlegume hay is fed, provide a small amount of cottonseed or linseed cake.

7. Feeding Horses and Mules

Work horses and work mules secure most of their feed requirement from hay and grain. Timothy hay is a standard roughage for these animals, although hays from other grasses and from legumes are also used in certain regions. Oats is more or less a standard grain in regions where it is grown. Corn is also fed, as are other grains common to certain regions. Corn is fed on the cob or shelled. Barley, wheat, rye, and sorghum grains should be ground coarsely if fed to horses.

Provide horses and mules with ample salt. Preferably, make it available in each stall in a special box, or provide access to it daily in the yard or pasture. When horses sweat considerably, plentiful quantities of salt are especially important. Horses drink 10 to 12 gal of water daily, and more in hot weather. Preferably, supply water three or more times daily.

Feeding Work Horses and Mules. In feeding a work horse or mule, take into account the severity of the work and the weight or size of the animal. In general, the heavier the work, the larger the proportion of grains in the ration and the less roughage. Furthermore, the larger the horse or mule, the greater the total quantity of feed that must be fed.

Another factor in feeding is the individuality of the work animal. Some animals are "easier keepers" than others of the same size and doing the same kind of work. Thus, to keep two horses in a team in equal condition, even though they are equal in size and working together, it may be necessary to feed slightly more grain to one than to the other.

The following guide is helpful in estimating the amounts of hay and grain to be fed to horses or mules, in accordance with size of animals and severity of work.

At light work. ½ lb of grain and 1¼ to 1½ lb of hay daily, per 100 lb of live weight.

At moderate work. 1 lb of grain and 1 to 1¼ lb of hay daily, per 100 lb of live weight.

At hard work. 1¼ to 1⅓ lb of grain and 1 lb of hay daily, per 100 lb of live weight.

Following the above guide, feed a 1,600-lb. horse at moderate work about 16 lb. of grain and 16 to 20 lb. of hay per day. Ordinarily, divide the grain into three equal feedings for morning, noon, and night. Feed about half the daily amount of hay at night, and divide the other half between the morning and noon feeds. The reason for this is that the digestive capacity of a horse (or mule) is somewhat limited. Working efficiency will be reduced if work animals are allowed to "stuff" or gorge on hay in the morning or at noon. During

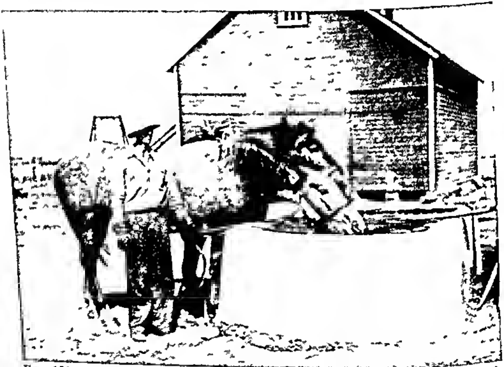

FIG 101 Horses, like other animals, need ample amounts of clean water This well-constructed concrete tank is suitable for watering either horses or cattle (*Portland Cement Association*)

the night, however, they have an opportunity to eat at intervals and can consume considerable bulky feed before morning.

On idle days, reduce the grain for horses or mules. A good rule is to reduce this part of the ration by at least one-half and increase the hay or other roughage. During idle seasons, horses can be maintained largely on cheap roughages such as straw, stover, and various hays.

Horses are sensitive to spoiled feed and sudden changes in rations. Use care in feeding or watering a horse that is extremely warm, especially in winter. Preferably, a horse that has worked up a sweat in

cold weather should be blanketed when placed in the stall and thus be allowed to cool off gradually before being fed or watered.

It is interesting to note that mules have more sense about eating and drinking than horses. Usually, they will refuse to eat or drink if they are overheated, and there is little danger that they will overeat when large quantities of feed are placed before them. Mules do not eat less feed than horses for the same amount of work done.

The following rations are suggested for horses or mules weighing about 1,200 lb. while at medium work:

1. Timothy hay or other grass hay, 14 to 15 lb , oats, 11 to 12 lb
2. Timothy hay or other grass hay, 14 to 15 lb ; corn, 9 to 10 lb.; linseed meal or other protein, 0.75 lb.
3. Legume hay, 12 to 14 lb ; corn, 9 to 10.
4. Mixed hay, 14 to 15 lb.; oats, 5 to 6 lb.; corn 4 to 5 lb.

Considerable use can be made of pasture for feeding work horses and mules. Many farmers allow horses to run on pasture at night and on idle days. In these cases, roughages in the form of hay can be considerably reduced.

Feeding the Brood Mare and Foal. In winter, feed idle brood mares some grain along with the usual roughage, and provide opportunity for exercise. After foaling, if the mare is not needed for work, she and her foal can be turned on good pasture and no other feed is necessary. If the brood mare is needed as a work horse, feed her similarly to a work horse, but provide her with slightly more grain. Some horsemen like to include bran up to 20 per cent by weight of the total grain mixture, and oats are preferred for the major part of the grain. Instead of bran, up to 5 per cent by weight of linseed meal may be included in the grain. If possible, on days when the mare has been worked, the mare and foal should be turned to pasture at night. During the day, while the mare is at work, keep the foal in a box stall that is darkened in fly season.

Feeding the Growing Colt. Give the foal grain as soon as a desire to eat is shown, which is usually at three to four weeks of age. Provide the foal with a grain box, and feed the grain regularly at the same time as the mother is fed. A mixture of 60 parts oats and 40 parts bran is satisfactory. At five to six months of age, when weaned, a colt will usually be eating 2 to 3 lb. of grain per day. Provide good-quality legume hay.

Feed the colt grain and good-quality roughage during the first winter of its life, with a grain allowance of about 1 lb. per day for each 100 lb. of live weight. From then on, the feed can consist primarily of good pasture in summer and good roughage in winter. Most horsemen like to continue to provide small amounts of grain for the growing colt, especially during the winter season.

Feeding the Orphan Foal. Occasionally a mare is lost at foaling time, and the colt lives. Sometimes a mare fails to produce milk following foaling. In either case, it may be possible to raise the colt by feeding cow's milk. If possible, use milk just milked from the cow. If the

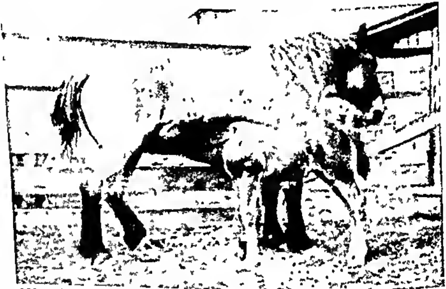

FIG 102 There is no feed so good as the mother's milk for young animals (*A. M Wettach, Iowa*)

milk is cold, warm it to 90 to 100°F. just before feeding. Prepare about 1 pt. of milk, with a tablespoonful of sugar and two or three tablespoonfuls of limewater added to it. Of this, give ½ pt. with a bottle and nipple every 2 hr. If the colt lives and shows signs of being hungry, increase the amount of milk by the time the colt is three or four days old. The sugar and limewater may be dropped at three to four weeks and the whole milk replaced by skim milk at four to five weeks. By this time, the colt should begin to eat a little hay and grain. Continue the skim-milk feeding until the colt is five months old. When the feeding of skim milk is started, a tablespoonful of cod-liver oil added twice a day will prove beneficial by helping to de-

velop stronger legs and feet. Most colts raised on cow's milk will begin drinking from a pail at about three weeks old. By the time the colt is four to five weeks old, ½ gal. of milk three times per day will be about the right amount.

Feeding Light Horses. Light horses need less hay and more grain, in proportion to their weight, than draft horses. Limit the hay to about 10 to 12 lb. daily for a 1,000 lb. horse. Timothy hay, with a mixture of a small amount of legume, is preferred by most horsemen. Oats are the preferred grain. Feed about 8 to 10 lb. of oats per day, divided into three feeds, with the evening meal the largest. About 2 lb. of wheat bran may be used to replace an equal amount of oats.

Light horses are often overfed and exercised too little. On days when they are not used, reduce the grain to about one-half this amount. Idle horses may be kept on pasture with no grain if the pasture is good.

SUPPLEMENTARY ACTIVITIES

1. Using the data in Table 5 or information from other sources, figure amounts of feed required for the livestock projects you are planning. Determine where these feeds are to be obtained and what they will cost. For the feeds your father can furnish from those already available on the farm, figure the price that you and he agree upon, preferably the "going" prices for such feeds.

2. With others in your class, visit the farm of a good hog raiser and study his feeding methods. Note the rations for breeding stock, young stock, and fattening. Ask questions of the operator to secure further details. After returning to the school, check and discuss the methods observed. What seem to be the most desirable practices? Were there any practices that you feel are undesirable? Which practices can you apply in your livestock projects? NOTE: Similar field trips can be taken to observe the feeding of dairy cattle, beef cattle, sheep, horses, and mules. Trips should be planned at the time some phase of feeding for an enterprise is being studied.

3. Make a list of the feeds commonly available on the farms in your community. Also, make a list of the feeds commonly purchased. Group the feeds into roughages and concentrates, and subdivide each of these into low-protein and high-protein feeds. Which of these feeds are suitable for hogs? Dairy cattle? Beef cattle? Swine? Horses and mules?

4. Secure prices charged locally for the various high-protein concentrates. Make a table showing the cost per pound of protein (based on total crude protein) as described on page 138 in this chapter. Which of these feeds appear to be the best "buy"?

5 Plan a succession of rations for the livestock in each of the projects you are conducting For example, figure rations for a brood sow, sow and litter, growing pigs and fattening pigs using the suggestions in this chapter and other appropriate information At each successive step in the cycle, put the corresponding ration into practice

6 With the help of your father, list the rations now in use for each kind of livestock on your home farm or ranch With this assistance, determine the feeds available, and decide what improvements in these rations would be desirable Aid him in putting these changes into practice NOTE In the case of dairy cows, figure a desirable grain mixture for the herd and the amount of feed for each cow

7 As indicated in the first part of this chapter, 100 lb of tankage when fed in proper amounts to young fattening pigs will save 607 lb of shelled corn With shelled corn at $1 75 per bushel, how much could you afford to pay per hundred for tankage? What is the present price for tankage? Will it pay to feed tankage at these prices? Figure the same problem with corn at the price it is actually selling for at the present time in your community

8 Plan a succession of pasture crops for the dairy herd or some other livestock enterprise on your home farm or ranch With the cooperation of your father, put this program into practice

9 Analyze carefully the various steps used in feeding the dairy herd or some other kind of livestock on your home farm or ranch Develop the schedule for feeding this herd that is most efficient in terms of time and effort

4. Providing Housing and Equipment for Livestock

THE ANCESTORS of farm animals, when still in the wild state, had no shelters comparable with the barns built by man. For many years after domestication, man gave little attention to the protection of livestock from unfavorable weather and to other means of making animals comfortable and secure. However, the improvement of animals through breeding for rapid growth and high production makes it necessary to provide comfortable and sanitary buildings and equipment if maximum production is to be secured. Every livestock raiser should give careful consideration to housing and equipment for his herds and flocks. The following activities are important in providing housing and equipment for livestock:

1. Planning Good Housing and Equipment
2. Providing Housing and Equipment for Hogs
3. Providing Housing and Equipment for Dairy Cattle
4. Providing Housing and Equipment for Beef Cattle
5. Providing Housing and Equipment for Sheep
6. Providing Housing and Equipment for Horses and Mules

1. Planning Good Housing and Equipment

Determining Important Factors. It should be emphasized at the outset that for humane reasons man should provide adequate shelter for the livestock he keeps. Greater satisfaction will be his if he knows he has been reasonably careful in providing for their protection and comfort. Furthermore, adequate provision for housing and equipment if kept on a practical basis will lead to increased profits from farm animals. This increased profit comes about through (1) increased production, (2) higher quality products, (3) decreased death losses, and (4) saving of labor.

Increased Production. Dairy cows, for example, must be reasonably comfortable and warm if they are to produce satisfactorily. It is of

little value to have well-bred cows if they are allowed to suffer because of inadequate housing. Meat animals must be given protection from cold winds and severe storms if they are to make the maximum gains from a given amount of feed. Self-feeders and other equipment if properly designed make it possible to reduce feed wastes and thus lead to increased pounds of gain or increased production from a given amount of feed.

Higher Quality Products. Milk produced under unsanitary conditions deteriorates rapidly and is objectionable for human food. Sanitary dairy barns and equipment and proper facilities for cooling are

FIG 103 Properly designed durable farm buildings arranged to save labor are important on a livestock farm or ranch This Washington farm shows a good arrangement of barns for a dairy farm (*K S Brown, Washington*)

essential for producing a high quality of dairy product (see Fig. 104). If subjected to extreme weather conditions, sheep may produce inferior wool, and all kinds of livestock may become unthrifty and unattractive to buyers.

Decreased Death Losses, Especially of Young Animals. The most critical time in the life of animals is at birth and for several days thereafter. Around 20 per cent of young animals die at this time. It has been estimated that these deaths result in the loss of about 10 per cent of the total feed consumed by all livestock. With pigs, the losses are even higher: nearly 4 out of every 10 pigs born never reach market. Many of these losses are the result of injury and chilling, much of which is traceable to poor housing and equipment. The

losses are especially great during the first 10 days after farrowing, because of overlaying or crushing by the sows. Guard rails and pig brooders will reduce these losses greatly, as discussed later in this chapter and shown in Fig. 116.

Excessive exposure to severe weather and to unsanitary conditions lowers the resistance of farm animals and makes them more susceptible to disease. Proper housing and equipment and sanitary surroundings will aid in maintaining animals in a healthy condition.

Saving Labor. Labor ranks next to feed in the cost of raising farm animals. Barns and equipment, properly designed and arranged, can

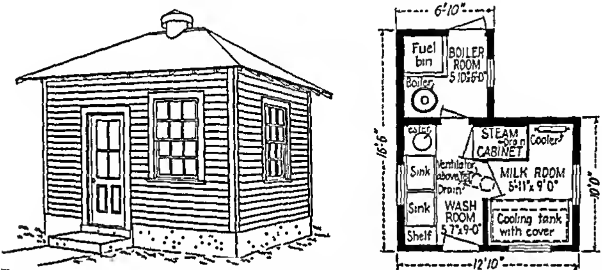

Fig. 104. Proper facilities for cooling milk and washing dairy equipment are necessary to secure a high-quality product. This type of milkhouse is suitable for medium-sized dairies where milk is hauled away in cans. (*Farmers' Bulletin 1214, U.S. Department of Agriculture.*)

lead to great savings in labor. For example, at the Vermont Experiment Station it was found that considerable time and energy could be saved in caring for a dairy herd by the addition of certain pieces of laborsaving equipment and by minor rearrangements of the interior of the dairy farm, coupled with careful replanning of the chore schedule[1] (see Figs. 124 and 125).

On many farms electrical devices are making it possible to save labor in caring for livestock. For example, electricity can be used for pumping and heating water, grinding and mixing feed, lighting the barnyard and barns, operating milking machines, elevating grain and other feed, and providing temporary fencing. Self-feeders and self-

[1] Labor Saving through Farm Job Analysis, *Bulletin* 503, Agricultural Experiment Station, Burlington, Vt., 1943.

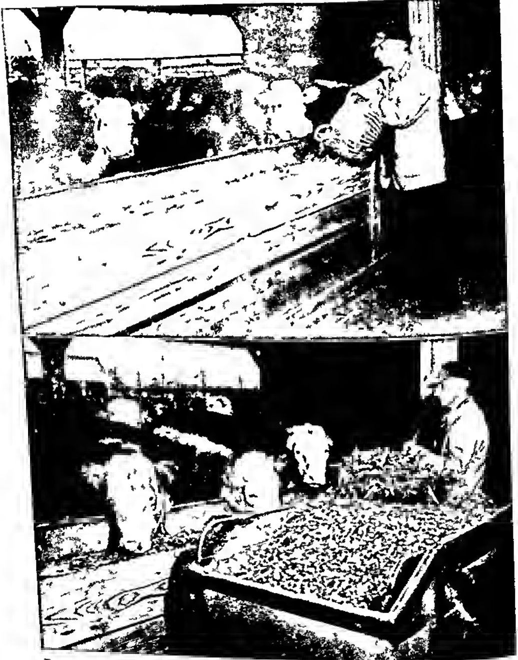

FIG 105 The feed cart shown in the lower picture saves time and energy in feeding steers as compared with the basket method shown above Many kinds of simple equipment may be purchased or constructed on the farm to save labor in caring for livestock. (*J C Allen and Son, West Lafayette, Ind*)

waterers for livestock are other pieces of equipment that aid in saving labor

To be most satisfactory, each building for livestock should be part of a well-planned farmstead, as shown in Fig 103 Keep facilities for feed storage and watering in or near the animals' quarters Place buildings as close together as possible without creating an undue fire hazard

Utilizing Scientific Methods for Constructing Buildings Desirable features in livestock buildings are (1) economy, (2) convenience, (3) warmth, (4) proper lighting, (5) proper ventilation, (6) comfort and safety for animals, (7) sanitation, and (8) adaptability and convertibility.

Economy A building for livestock should be reasonable in cost, durable, and inexpensive to maintain Just as it is poor business to keep good livestock in poor buildings, it is also poor business to keep low-grade, poorly fed livestock in expensive quarters or to construct highly expensive buildings even for good livestock Keep building costs down by converting or remodeling buildings already available In fact, do this wherever possible as shown in Fig 106, rather than erect costly new structures Keep the cost of buildings in proportion to the value of the farm

Under some conditions, one may construct inexpensive buildings largely from materials at hand, such as salvaged or home-grown lumber, stone, and sand or gravel obtained from nearby sources for mixing concrete An inexpensive straw shed can be constructed as a temporary shelter for hogs or other livestock Such a shelter, if properly built, is warm and dry, and animals kept in it are frequently healthier than those kept in a tight, poorly ventilated building

Convenience A building for livestock should be carefully planned so that labor will be kept at a minimum, as explained earlier in this chapter Locate bins for feed and hay chutes in convenient places Use laborsaving devices for distributing feed and for cleaning out the manure. Locate feed racks, stalls, stanchions, and other equipment so as to save labor. In so far as possible, make each building a complete unit with respect to feed, water, bedding, and tools Install doors and gates that can be opened and fastened quickly Plan the entire layout to make possible the development of a chore schedule that saves time and steps, as discussed in the section for dairy cattle, and as illustrated in Fig 124

Warmth The degree of warmth in a building should be suited to the kind of livestock Sheep horses, and beef cattle for example can be kept in colder quarters than dairy cattle Consequently, walls of buildings for the former can be built with less insulation than for

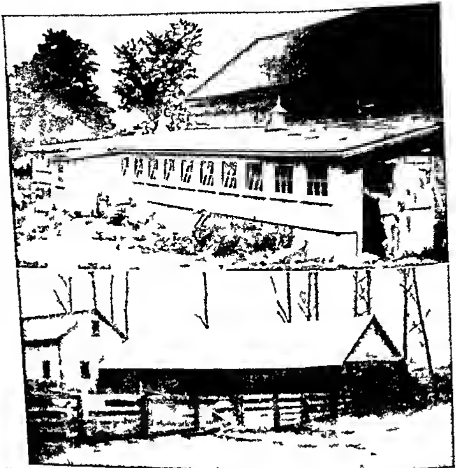

Fig 106 Suitable buildings for housing livestock may be economical in cost. *Above* a new lean to for dairy cows that joins an older structure where hay is stored *Below* a shed with walls made of baled straw and with a galvanized iron roof This is a suitable building for housing beef cattle or sheep (*Upper photograph by R. L. Hahn Connecticut lower Minnesota Experiment Station*)

the latter As a matter of fact extreme warmth is unnecessary for any kind of livestock Barn temperatures of 40 to 45°F are sufficient for dairy cattle Higher temperatures are desirable primarily for the comfort of the caretaker rather than for the animals Greater warmth is desirable however at the time animals are born For pigs at farrowing time, the temperature at the floor level should be 60 to 65°, or

provisions should be made for pigs in a warm place as they are born. In northern climates, it is well to insulate the walls, especially of dairy barns and hog houses.

Lighting. Buildings for livestock need sufficient window space to provide a fair amount of natural light in the interior. For example, 1 sq. ft. of window space per 20 sq. ft. of floor space is a desirable standard for most kinds of livestock. Excessive window space brings about an undesirable cooling effect, as windows are poor insulators. Use large windows (nine-light size, usually) and fewer of them, as thus the walls are less cut up. Provide artificial lighting so that you can

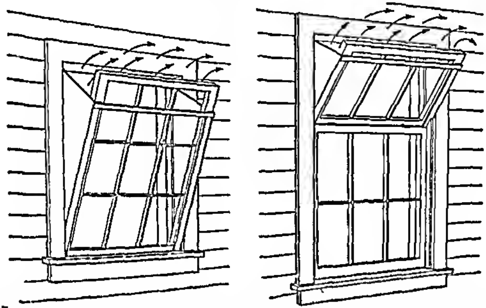

FIG. 107. Two methods of arranging windows for barn ventilation. Such systems are satisfactory for cool buildings where animals are free to move about. They are especially suitable in regions where winters are mild. (*Farmers' Bulletin 1393, U.S. Department of Agriculture.*)

work efficiently during hours when there is insufficient light from natural sources.

Ventilation. Animals in breathing give off much moisture; unless there is a reasonable circulation of air, excessive dampness may result. This condition may also be due, in part, to insufficient insulation, which leads to the condensation of moisture on walls and ceilings in cold weather. Circulation of air is also desirable to reduce odors, which are offensive to the caretaker and in a dairy barn may result in tainting the milk. Provide ventilation through windows hinged at the bottom as shown in Fig. 107. Possibly in colder areas a system will require inlet and outlet flues, similar to those shown in Fig. 108.

In some cases, outlet fans are installed in openings in the outside walls of barns One fan of suitable size is usually sufficient for a medium sized barn, two or more are required in a large barn These are operated by electric motors automatically controlled by thermostats When the temperature rises to the point for which the thermostat is set, the motor is started and operates the fan until the temperature is lowered sufficiently to cause the thermostat to disconnect the flow of current Through forced ventilation of this type, dampness

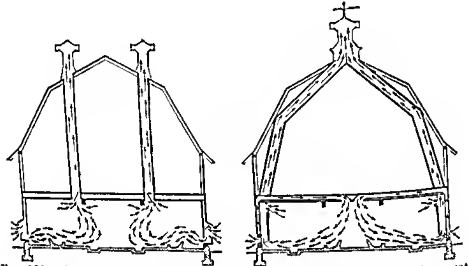

Fig 108 A special ventilation system is desirable for dairy barns in Northern states At *left* the Rutherford system of ventilation at *right* the King system for a barn arranged with cows facing in Note the main differences between these two systems In many modern barns these types of ventilation have been modified by the use of thermostatically controlled electric fans for forced ventilation (*Farmers' Bulletin 1393 U.S Department of Agriculture*)

is reduced, due to the effective removal of the moisture laden air in the stable

Comfort and Safety for Animals The space provided in a building should be carefully planned so that it will be sufficient but not excessive for the number and kind of animals to be kept Standard space requirements for various kinds of livestock are indicated in later portions of this chapter If these recommendations are followed, the animals will be more comfortable and less likely to injure each other Construct wide doorways for animals such as pregnant ewes and thus prevent crowding and consequent injury to them, as shown in Figs 109 and 135 Keep buildings free from projections and overhead obstruc-

tions which might cause injury to animals. Construct concrete floors with the surface left sufficiently rough to prevent animals from slipping when the floors are wet.

Sanitation. A building for animals should be so constructed that it can be kept sanitary with a reasonable amount of labor. Use concrete floors wherever possible, as these are most suitable for cleaning and for maintaining proper sanitation. Construct smooth walls and make ceilings tight to prevent sifting of dust from haymows, especially in dairy barns.

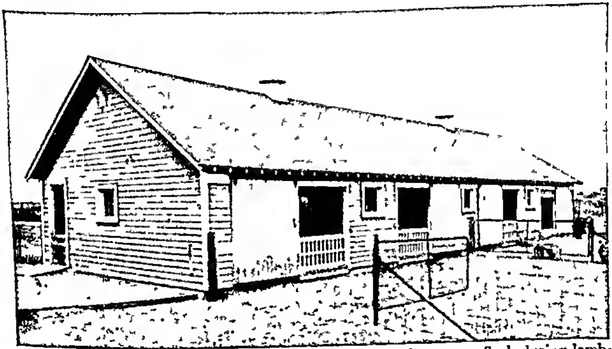

FIG. 109. A suitable shed for wintering sheep and housing a ewe flock during lambing. Note the wide doors to prevent crowding of ewes in entering or leaving the shed. This type of shed can easily be converted to housing other kinds of livestock. (*Minnesota Experiment Station.*)

Adaptability and Convertibility. Buildings for livestock should be so constructed that some shifts are possible without expensive remodeling. The so-called "general-purpose" barn is frequently built for two or more specific kinds of livestock, for example, dairy cattle, sheep, and horses, as shown in Fig. 111. In the usual dairy barn, stanchion space is provided for all cows. It may be desirable to use a pen-type arrangement for dairy cattle, as described on a later page, and thereby provide space that could be converted for beef cattle or sheep. Often, with a small expenditure for remodeling, a building already available can be converted into the pen-type arrangement and thus provide facilities at a low cost for dairy cows.

2. Providing Housing and Equipment for Hogs

In general, two methods for housing swine are used: (1) the central, or stationary, hog house; and (2) the colony, or portable, hog house. The advantages of each are discussed in the following paragraphs.

Providing and Using a Central Hog House. Central hog houses have special advantages on farms where large numbers of hogs are raised. The labor at farrowing time is reduced by having a carefully arranged central hog house similar to the one shown in Fig. 112. Feed and supplies are stored close at hand. In cold weather, artificial heat can be provided readily at farrowing time, if desired, and closer supervision given to the sows and litters than when they are

FIG 110 A combination or general purpose barn suited to many farms See the ground plan in Fig 111 (*U.S Department of Agriculture*)

scattered in small colony-type hog houses. On the other hand, a central hog house is expensive; therefore, the hog enterprise should be sufficiently large to make it possible to use it for a large part of the year. Some hog raisers have sows farrow in the central house in two or more groups, spaced to permit the sows and litters to remain there until they are hauled to a clean pasture, where they are placed in movable hog houses.

It is difficult to keep conditions sanitary around a central hog house. Old hog lots become contaminated with worm eggs and organisms that cause unthriftiness and certain serious diseases, as discussed in Chap. 6. Unless care is exercised to keep the pigs out of such lots, severe losses may result. Within the hog house, concrete floors are preferable because they can be kept sanitary most easily.

In most cases, pastures are used in connection with centralized

facilities. The best hog raisers are using a rotation of pastures to provide "clean-ground" grazing each season. Keep the lanes or runways to the pastures in a sanitary condition; this is important.

Some hog raisers are building centralized facilities that make it possible to keep hogs confined from birth to market. These so-called "confinement systems" consist of a central hog house with adjoining

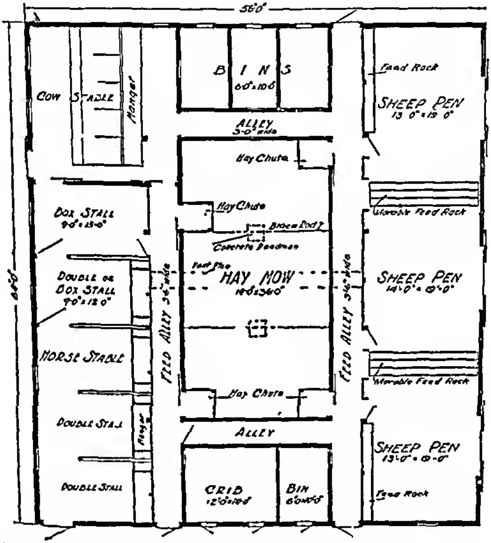

FIG 111. Ground plan for general-purpose barn shown in Fig 110 (*U.S. Department of Agriculture.*)

platforms made of concrete. The portions made of concrete, including the floor of the house, are kept scrupulously clean to prevent the pigs from becoming contaminated with disease germs and parasite eggs.

A central hog house is usually built with removable partitions so that farrowing pens can be provided when desired. Allow at least 48 sq. ft. of floor space for the farrowing pen for each sow. As the pigs get older, remove the partitions so that the sows and their litters will

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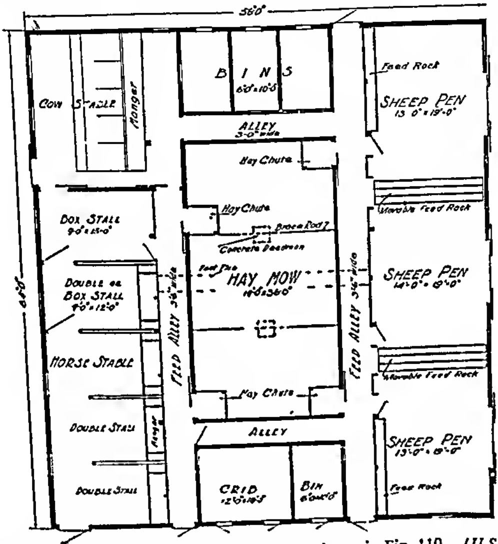

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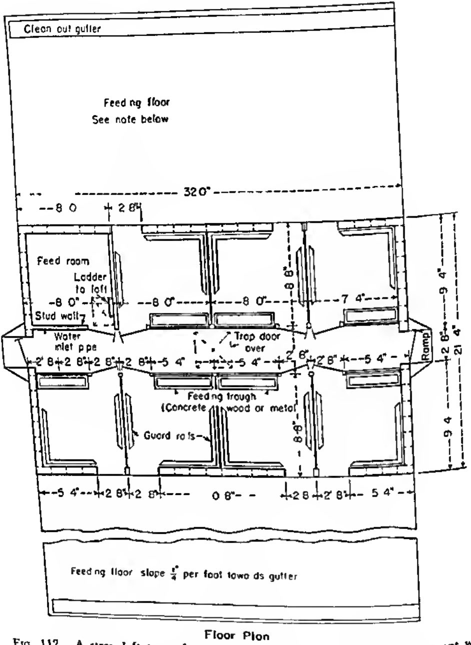
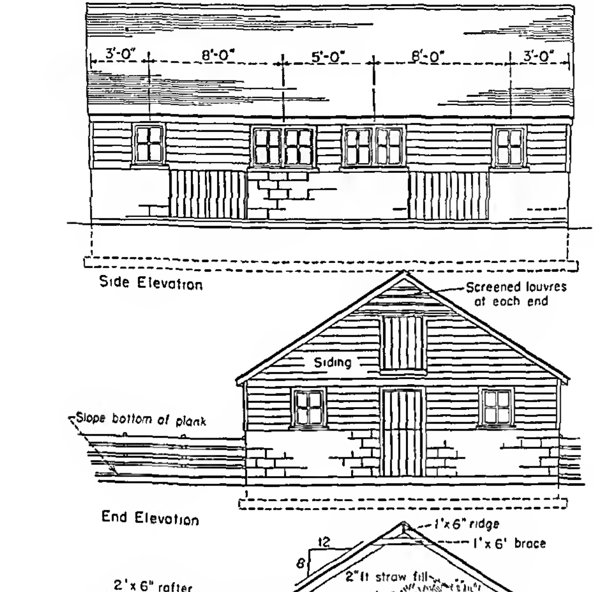


FIG 112 A straw loft type of central hog house Note interior arrangement with run together Note various features of the central farrowing house shown in Fig 112

Building and Using Portable Hog Houses. For small herds of swine of six or eight brood sows, colony, or portable, hog houses are satisfactory and economical These are sometimes called "individual" houses,



removable partitions, guard rails, and feed storage. (*University of Illinois.*)

because many of them are built to accommodate one brood sow and her litter. Another name for these buildings is hog "cots." Many hog raisers prefer larger units. The original cost of movable, or portable, houses is considerably less than for a central hog house accommodating the same number of sows and litters. Furthermore, these

buildings move easily to sanitary surroundings, such as pastures where no pigs have grazed since the field was last seeded. Some suggested types of movable hog houses are shown in Figs. 113, 114, and 119.

At farrowing time and following, some hog raisers find it a good practice to tilt the portable houses so that the floors slope to the rear. On such a floor, the sow is inclined to lie with her back toward the higher side and the pigs tend to go to the lower side, where a pig brooder or guard rail gives them extra protection. A slope of about

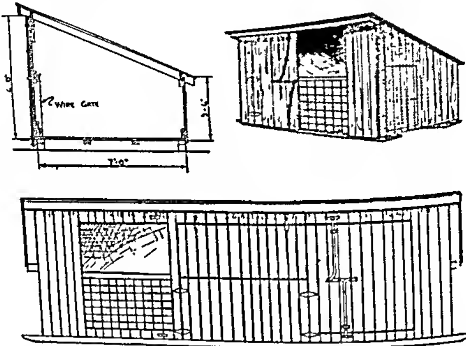


Fig 113 A portable farrowing house suitable for two sows and litters. The house is 12 ft. long and 7 ft. wide During mild weather, the doors may be left open and a wire gate used to keep the pigs confined if desired (*Circular 554, Illinois Experiment Station*)

1½ in. per foot has been found satisfactory. Make this provision by placing blocks under the front end of the hog house to raise it up the proper amount or by constructing the floor with the desired amount of slope.

Many farmers are successful with the arrangement of having the sows farrow in portable houses on clean pastures. The sows and their pigs, and later the pigs alone, are housed in these quarters. Such a plan is especially suitable for a boy who raises one or more litters separate from the main herd.

Portable houses are less convenient than central houses in caring for hogs. More labor is required in caring for the sows and litters at farrowing time and it is more difficult to maintain a comfortable temperature for farrowing in cold weather than is the case with a central hog house.

Many hog raisers find it desirable to have a central hog house and several movable houses, as suggested previously. The central hog house is used for farrowing quarters. After the pigs are about two weeks old, the sows and litters are hauled to a clean pasture and placed in portable houses as discussed in Chap. 6. The central house may be used as farrowing facilities for successive lots of brood sows, spaced at proper intervals. It may also be used as quarters for fattening the

FIG. 114. Two pieces of hog equipment built by students of vocational agriculture in a school farm shop at Canal Winchester, Ohio: *left*, a self-feeder; *right*, a small-sized, movable, single-sow farrowing house. (*R. E. Bender, Ohio.*)

pigs after they are brought in from the pasture. In this case, the hogs should be kept out of the old hog lots until they are at least four months of age and preferably longer.

Providing and Using Appliances for Hogs. Among the pieces of equipment and appliances usually desirable are self-feeders, pig brooders, guard rails, self-waterers, loading chutes, pig creeps, artificial shade, and hog oilers.

Various types of self-feeders have been designed of which one style is shown in Fig. 115. Ordinarily, construct self-feeders with two or more compartments, so that grains can be placed in one section and protein feeds in another, as discussed in Chap. 3. Provide a compartment for a mineral mixture or salt either in the large feeder or in a separate feeder. Some hog raisers prefer to have a small feeder with

two compartments for minerals, one section for the mineral mixture, and one for salt. Provide racks for feeding alfalfa hay, especially for brood sows in winter. One type of rack is shown in Fig. 115.

By using brooders for small pigs, you can often save extra pigs during the first few days following farrowing. In tests at the Indiana Experiment Station and the U.S. Department of Agriculture, Bureau

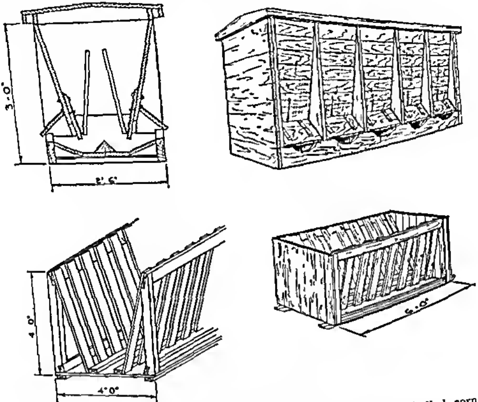


FIG 115 Equipment for feeding hogs: *above*, a self-feeder for shelled corn or ground grain, protein supplement, and mineral feeds; *below*, a rack for alfalfa or other legume hay (*Circular 554, Illinois Experiment Station*)

of Animal Industry, it was found that electric pig brooders saved an average of 1 to 1½ more pigs per litter than was possible without them. In a central hog house, the best location for the pig brooder is usually in a corner of the farrowing pen near the alley. A pig brooder can also be placed in a portable hog house. Electricity is the most suitable source of heat, as shown in Fig 116. Use a light bulb with a reflector or the heat type of reflector lamp. Place boards across the front above the entrance of the brooder to prevent damage by the sow and pigs.

Install pig fenders or guard rails in farrowing pens to keep the sows from lying on their pigs. The usual type consists of rails fastened about 8 in. from the walls and about 8 in. above the floor as shown in Fig. 116.

Provide self-waterers that furnish a plentiful supply of clean water at all times. Various barrel types are available, as well as types that attach to a pipe line in a farm water system. One homemade type

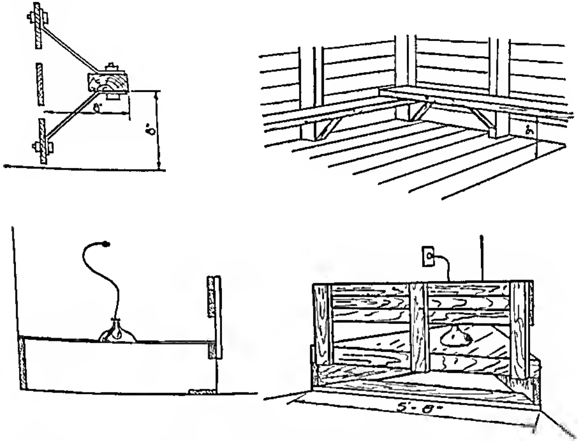


FIG. 116. Satisfactory guard rails and pig brooders aid in saving pigs at farrowing time: *above*, two types of guard rails; *below*, a pig brooder heated by a 100- or 150-watt electric bulb. (*Circular 554, Illinois College of Agriculture.*)

is shown in Fig. 117 and one commercial type in Fig. 76. In cold climates, during the winter season it is desirable to have a type of waterer in which an electrical unit or some other type of heating is provided to prevent freezing of the water.

Loading chutes are desirable for preventing injury to hogs in loading them on or off a truck or wagon. One type is shown in Fig. 118.

You may wish to construct a pig creep and thus provide a place for young pigs to eat and rest apart from their mothers, as discussed in Chap. 3. This may be provided in one part of the central hog house

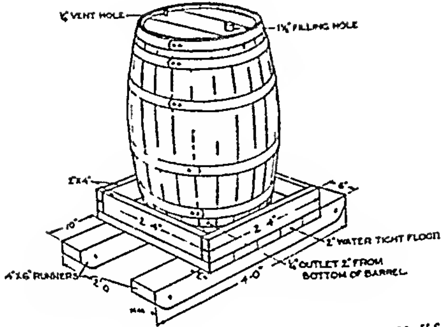


FIG 117 A homemade self waterer for hogs (*Farmers' Bulletin 1490, U S Department of Agriculture*)

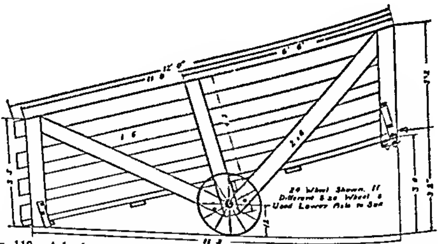


FIG 118 A loading chute that can be easily moved about is handy for loading and unloading hogs or sheep (*Bulletin 286 Kansas State College*)

in the form of a small pen For one side of this pen, use a panel with one or more openings large enough for the pigs to pass through freely Provide a similar type of creep for the pigs on the pasture, either in one of the portable houses or out of doors, as shown in Fig 81

Provide artificial shade during the hot summer weather, unless enough natural shade is available Some types of portable houses are

constructed with sides that can be raised to provide shade, as shown in Fig. 119.

Many hog raisers furnish oilers or rubbing posts to aid in the control of lice. Construct a rubbing post by wrapping burlap around a

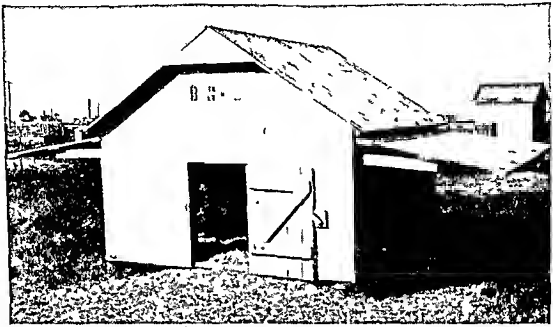


FIG 119 A one-sow type of portable hog house which can be converted into a sunshade for hogs on pasture in the summer (*Minnesota Experiment Station.*)

short post set in the ground, and keep the burlap saturated with used crankcase oil.

3. Providing Housing and Equipment for Dairy Cattle

Good housing and equipment are especially important for dairy cattle because they need comfortable quarters if they are to produce most satisfactorily. Since labor is an important item of expense with dairy cattle, it is desirable to provide facilities that keep costs at a minimum.

Providing and Using a Dairy Barn. Where fairly large herds of dairy cattle are kept, a special dairy barn is usually provided. Where small herds are kept, they are usually housed in a part of a general-purpose barn, as discussed later.

In general, special dairy barns can be classified into two types: (1) conventional barn, in which stanchions are provided for all milk cows; and (2) the pen-type barn, in which most of the space is used for a large "loafing pen," where the cows are allowed to run loose for the major portion of the time during the season when they are not on pasture.

The Stanchion-type Barn. The stanchion-type barn for dairy cows is as yet the more common. In this type, the stanchions are usually arranged in two rows running lengthwise, with pens at the end for calves, for cows during calving, and sometimes for a bull, as shown in Fig. 120. The silo is commonly located at one side or the end of the barn. A feed room can be provided in the entryway between the silo and the barn or in a portion of the barn proper. Most barns are constructed with a mow overhead for storage of hay and straw.

The stalls in which the cows are stanchioned should be of a length from gutter to manger that is suited to the size of the cows. In build-

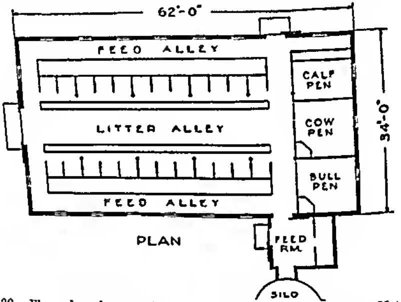


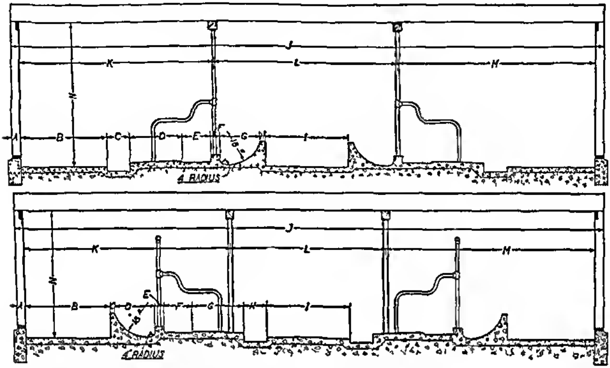
FIG. 120 Floor plan of a typical stanchion type barn for dairy cattle. Note various features of interior arrangement. (*Leaflet 232, U.S. Department of Agriculture.*)

ing the interior of dairy barns, some persons prefer to construct the stalls so that they taper slightly in length from one end of the row to the other, beginning with the longest and ending with the shortest needed for the breed and age of cows represented. Suggestions for appropriate lengths for each breed are included in Fig. 121. It is desirable to have a rail or pipe on each side of the space for each cow and thus provide a stall that aids in preventing udder injuries. Stall widths range from 3 to 4 ft., depending on the size of cows, although 3½ ft. is a standard width with partitions and 3 ft. without.

There are two types of mangers for dairy cows. One is the "sweep-in" type having a feed alley on a level with the front of the

manger. The other is the raised-front manger, which extends 20 to 30 in. above the floor level. The latter type is shown in Fig. 121.

In dairy barns of the stanchion type, the interior can be arranged so that the cows either face in or face out, as shown in Fig. 121. It is generally agreed that, with cows facing out, milking is more convenient and the cleaning operations are easier. Also, the cows show up to a



J	Width of Barn	32 feet	34 feet	3[illegible] feet
A	Stud	0 6"	0-6	0-6
B	L. Alley	4-5	5 0	5-0
C	Gutter	1 4	1 4"	4
D	Platform	3 0"	3-0"	3-0"
E	Depressed Platform	1 8"	1-8"	[illegible]
F	Curb	0-6"	0-6"	0-6"
G	Manger	2 4"	2-4	2-4"
H	Manger Curb	0 3"	0-3"	0 3
I	Feed Alley	4 0"	4-10"	6-10"
K	Left Bent	10 6	1-3"	1 3
L	Center Bent	9 6	9-6	2 6"
M	Right Bent	10 8	1-3"	1 3
N	Height	7 6"	7-6"	7 6"

J	Width of Barn	32 feet	34 feet	36 feet
A	Stud	0 6"	0 6	0-6
B	Feed Alley	4-0"	4 5	4-5"
C	Manger Curb	0 3	0 3"	0 3"
D	Manger	2 4"	2-4"	2 6"
E	Curb	0-6"	0-6"	0-4
F	Depressed Platform	1-8	8	1 6"
G	Platform	3 0"	3 0"	3-0"
H	Gutter	1-4"	1-4"	1-4"
I	L. Alley	4 8	6 0	8-0"
K	Left Bent	-6	10-6	6"
L	Center Bent	9 0"	9-0"	12 0"
M	Right Bent	8"	12-0"	6"
N	Height	7 6"	7 6"	7-6"

Breed	Length of Platform		
	Small	Medium	Large
Holstein	4 10	5 2	5 8
Shorthorn	4 8	5 0"	5 6
Ayrshire	4 6	5' 0"	5' 6
Guernsey	4' 6"	4 10"	5' 6"
Jersey	4-4"	4-8"	5 0"
Heifers	3 8	3 6"	4 2"

Fig 121 Standard dimensions for laying out dairy barns *Above,* the face-in arrangement for two rows of cows, *below,* the face-out arrangement Note table of dimensions at lower left for face in type, at lower center for face-out type, and at lower right for length of platform for each breed (*Extension Bulletin 101, Michigan State College*)

better advantage. On the other hand, with cows facing in, feeding is made easier and there is more natural light from the windows for the milker.

Concrete floors are usually preferred in dairy barns. Floors next to stanchions should slope toward the gutter about ¼ to ⅓ in. per foot.

The Pen-type Barn The pen-type barn is coming into extensive use. In this type of barn, during the season when shelter is needed

the cows are allowed to run loose in a large room or shed which is sometimes called the "loafing" or "resting pen" A milking room, or milking "parlor" is provided in a separate building or in a part of the barn adjacent to the loafing pen This milking room is equipped with stanchions mangers for feeding grain etc, similar to a stanchion type barn However stanchions are provided for only a few cows, usually four to six With this arrangement the cows are fed grain and milked in relays in the milking room Hayracks and silage bunks are provided near the loafing pen Facilities for watering are often provided in the form of a small tank near the loafing or resting pen Provide 70 to 80 sq ft of floor space per cow in the resting pen, exclusive of feed racks

The University of Wisconsin conducted an experiment with dairy barns in which two groups of cows were compared One group of cows was left in a cool pen type barn during the winter, the other group was kept in stanchions as in a typical dairy barn After 10 years of careful checking it was found that the amount and quality of milk were similar under both systems The general health of the cows was about the same under both systems but under loose housing there were fewer udder injuries and less lameness from injured knees and hocks Less labor was required under the latter system if an efficient milking parlor was provided If a few minutes were used each day to throw the fresh manure to the sides of the bedded area only about 10 per cent more bedding was required than in the stanchion type of barn It was found that a cool building is much preferable to a warm building for loose housing as in the latter case the cows become dirty from damp soiled bedding

Feeding and watering areas in a loose housing setup should be paved and they should be cleaned daily These areas should be separate from the bedded area which need not be paved The bedded area is cleaned but once yearly usually in the spring after the herd is turned to pasture All cows should be dehorned to prevent injury from "boss" cows Young stock should be separated from the milking herd See Fig 122 for some of the features of one type of loose housing setup and Fig 123 for a convenient type of milking parlor

Using a Dairy Barn Whatever the type of barn careful planning should be done to eliminate unnecessary labor Frequently such planning makes it possible to save considerable work First carefully analyze the time and steps required to do the jobs in the chore schedule at

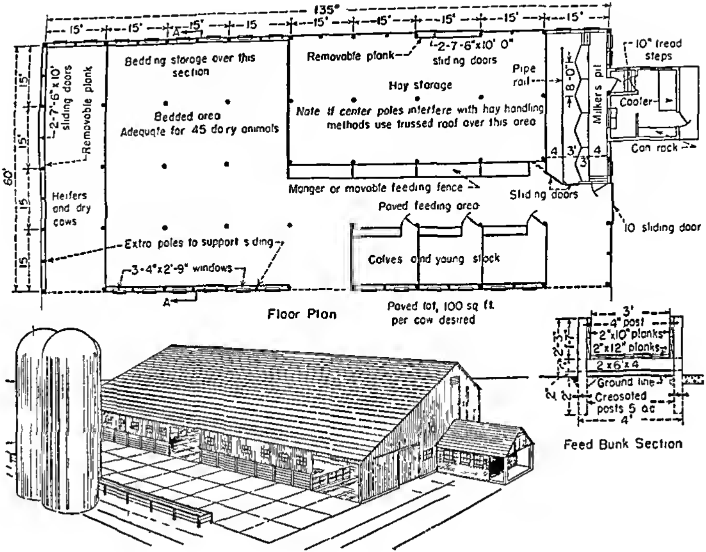


FIG 122. The pen, or loose-housing, type of barn is coming into use. This barn is of the pole type. (*North Central land-grant colleges in cooperation with the U.S. Department of Agriculture.*)

Fig 123 A convenient type of milking parlor showing stalls and milking pit (*Babson Brothers Company*)

present Then make changes and adjustments as seem desirable to save time and effort In cooperation with a dairy farmer in Vermont, plans were made and put into practice for a 22-cow herd that resulted in a saving of approximately 2 hr of time and 2 miles of walking per day[2] Over a period of a year, these savings amounted to approximately 60 twelve-hour days and 730 miles of walking The actual cash spent in making the necessary changes in the barn and equipment was less than $50

The savings in the above case were the result of the following types of changes and adjustments

1 Some rearrangement of the interior of the barn as shown in Fig 125
2 Construction of laborsaving equipment, suited to this barn, for removing manure, feeding grain, and feeding silage A manure cart and feed cart were constructed and put into use (see Fig 124)
3 Change in location of tools and supplies as shown in Fig 125
4 Improvement of work routine
5 The adoption of fast or managed milking methods as shown in Fig 149

[2] Labor Saving through Farm Job Analysis *Bulletin* 503, Agricultural Experiment Station Burlington, Vt., 1943

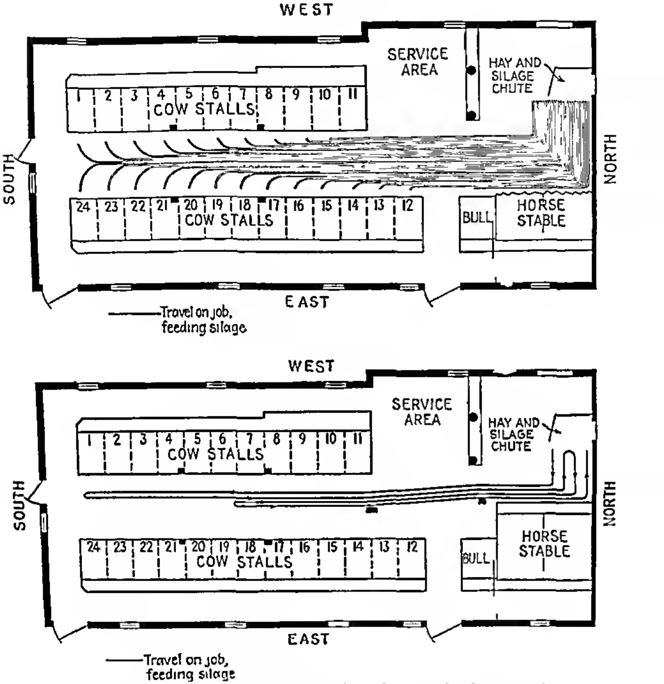


FIG 121 The bushel-basket method of feeding silage in this barn required many trips, totaling 2,070 ft or ⅖ mile daily, as shown by the black lines in the top sketch By using a silage cart, this distance was reduced to 190 ft., as shown in the lower sketch The number of trips is shown in each case by the black lines. (*Bulletin 503, Vermont Experiment Station*)

Converting Part of a Building for Dairy Cattle. Often, dairy cattle are kept in part of a general-purpose barn where one or more other kinds of livestock are kept. It is desirable to have the portion for dairy cattle partitioned separately from the rest of the barn, as it is easier to regulate the temperature in accordance with what is desirable for the cows and the comfort of the caretaker. Furthermore, by this means, dust and

undesirable odors from other parts of the barn can be blocked off, as shown in Fig. 141.

Frequently, a farmer having a fairly good barn originally built for other livestock may wish to convert part or all of it for dairy cows. This

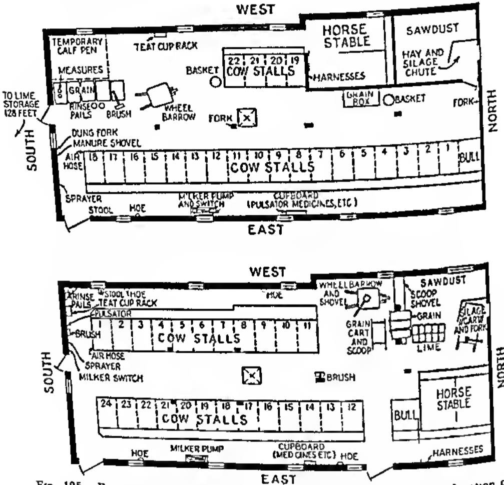


FIG 125 Rearrangement of the interior of the barn together with a relocation of tools and supplies will often save considerable time and energy in caring for dairy cows or other livestock The arrangement in this Vermont dairy barn was changed from that shown in the upper drawing to that shown below, with a marked saving of labor in caring for the dairy herd (*Bulletin 503, Vermont Experiment Station*)

can usually be done quite economically In many instances, the pen-type arrangement may be the most economical to develop within such a barn. On the other hand, it may be better to develop the stanchion-type arrangement. In either case, suggestions given on previous pages should be helpful.

Constructing Pens for Dairy Calves. In general, two types of pens are in use for calves In one type, several calves run together in a fairly large pen. Provide 20 to 25 sq ft. of floor space for each calf when about three weeks old. Have stanchions as shown in Fig. 127 so

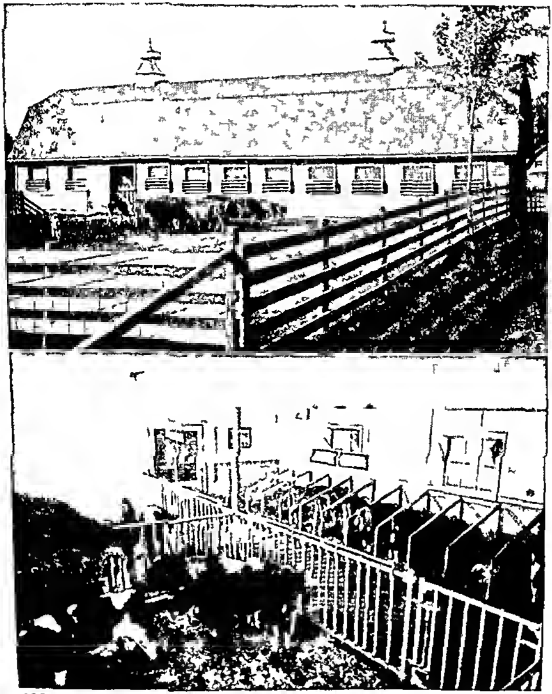


Fig 126 Exterior and interior views of a special barn for dairy calves Note various features of construction (*Boulder Bridge Farms, Minnesota*)

that calves can be confined after each feeding of milk, and thus prevent the formation of the habit of sucking each other. Provide mangers for hay and feedboxes for grain. For water, use drinking cups, pails, or small tanks. Provide a small box or other type of container for salt.

In the other type of pen, each calf is confined separately until it is about four weeks old. Such pens are quite small, depending on the size of the calf. Provide pens about 3½ by 5 ft. in size. Such a pen permits more individual attention to calves, prevents them from sucking each other, and aids in checking the spread of disease.

In some cases, pens with false floors are provided. Raise the platforms on which the calves stand about 3 to 4 in. above the real floor. Make the false floor of heavy-mesh wire, slats, or steel grating. Place bedding on this floor. In large pens for several calves, the false floor

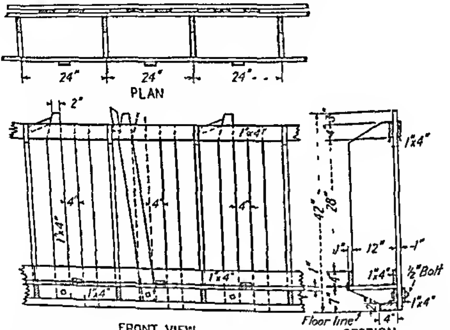


Fig. 127. Stanchions for calves are desirable to confine calves after they have been fed milk, thus preventing the habit of sucking each other. *(U.S. Department of Agriculture.)*

may be built in one corner or over about half the floor space, where it will be used by the calves when lying down. In individual pens, the entire floor may be of this type. These floors should be constructed in sections so that they can be removed readily for cleaning. Calves kept in such pens are cleaner and drier, as the liquid manure passes through the false floor.

Providing Shelter and Yard for the Dairy Bull. A bull should have a shelter and pen that provide protection and exercise for him and safety for the caretaker. A box stall in the barn connected with an outside

safety bull pen is desirable. The safety bull pen can be constructed from horizontal pipes set in concrete posts. A breeding stall so constructed that the bull does not need to be handled is also valuable. Some people prefer large bull yards, up to an acre in size, to provide pasture as well as exercise. By wires properly placed on the inside of the fence and electrically charged through approved appliances, the bull is safely confined to the yard.

Installing and Using a Milking Machine. Whether or not a milking machine will be a profitable investment depends primarily on the size of the herd and the labor supply available. Milking machines reduce

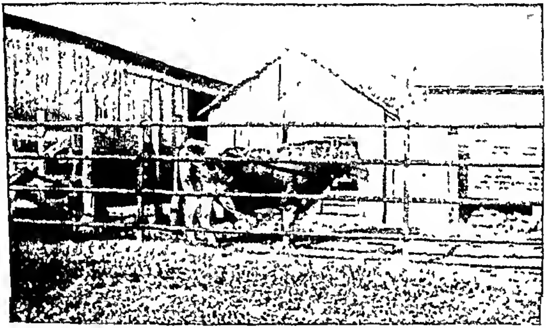


FIG. 128. One type of yard construction for a safety bull pen. Discarded boiler pipes were used for the bars of the fence. (*Dairy Extension Service, Michigan State College.*)

time of milking 50 per cent or more. However, unless the herd is fairly large, the depreciation on the machine and the labor in cleaning and caring for it may offset the time saved in milking. For herds of 20 cows or more, machines for milking are usually desirable, unless plenty of low-cost labor is available. If labor costs are exceptionally high, a machine may be a good investment for herds of 10 or 12 cows. With a milking machine, it is possible to employ persons who dislike hand milking or are unable to milk effectively.

Experiments show that there is little or no difference in the production of cows under hand milking and machine milking. There may be more tendency toward udder ailments with the machine milker if the

teat cups are not sterilized properly, or if the machine is left on the cows too long.

In using a milking machine, the fast-milking or managed-milking system is being used with success by many farmers. After a period of adjustment, it has been found that most cows will "let down" their milk rapidly and require little or no stripping. If stripping is practiced, it can be done with the machine or by hand. It should be done immediately

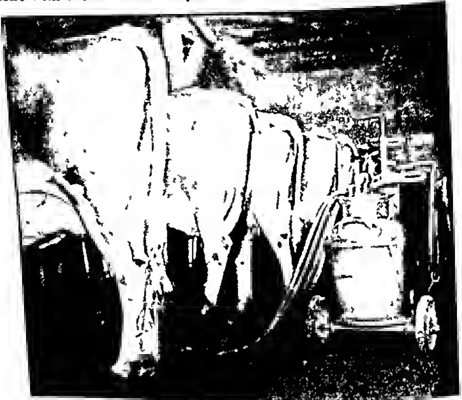


FIG 129 Milking machines reduce time of milking up to 50 per cent. This is a double-unit model For use with the fast milking technique or for weighing the milk from individual cows, the single-unit model is preferable (*Rural Electrification Administration*)

and rapidly after the machine is removed. If the fast milking system is used, single-unit machines are usually preferred. Further information on the steps in fast milking is given in Chap. 5.

4. Providing Housing and Equipment for Beef Cattle

Beef cattle have a thick covering of flesh, a fairly thick skin, and a dense coat of hair, which combine to give them considerable natural protection against low temperatures. Consequently, they can be housed in buildings which are quite cold.

Providing Shelter for the Beef Breeding Herd. In warm climates, no shelter is needed for beef breeding herds. Even in cold climates, they can be housed in inexpensive quarters. The main requirements of shelter are that it be dry and that it protect the animals from exposure

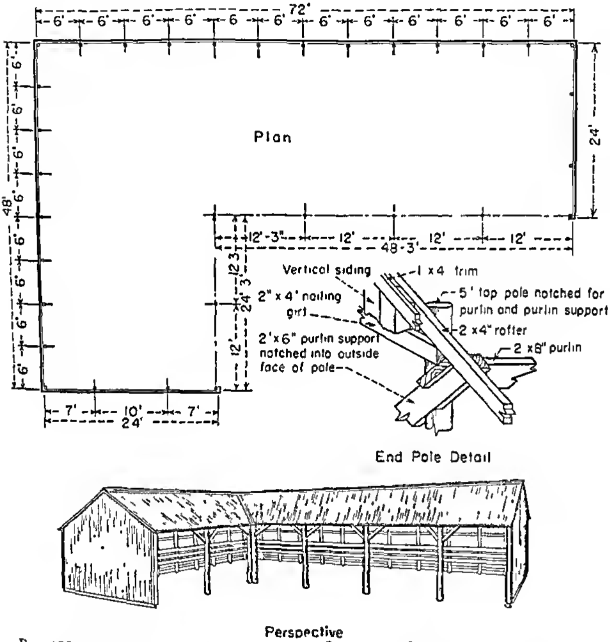


FIG. 130. An open-front, pole type of shed for housing beef cattle. (*North Central land-grant colleges in cooperation with the U.S. Department of Agriculture.*)

to cold winds and severe storms. Open-front sheds as shown in Figs. 130 and 131 are sufficient for mature cows, even in the Northern states, although some beef producers prefer to build more elaborate structures as shown in Fig. 132. The main portion of such sheds or barns is usually designed for cattle to run loose, with an average of around 40 to 50 sq. ft. of floor space per cow. If calves are born in winter, provide

one or two box stalls for confining the cows at calving time A common size for box stalls is 10 by 12 ft

In the Southern states and in most range states, little or no housing is provided for the breeding herd

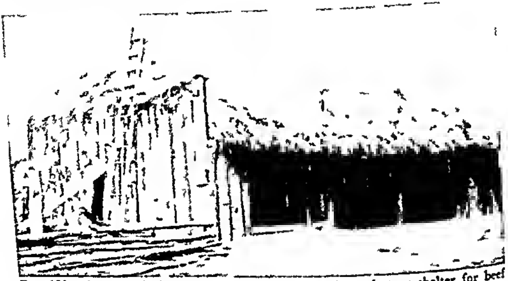


FIG 131 A straw shed provides an inexpensive and satisfactory shelter for beef cattle The sides of this shed are constructed with slabs from a local sawmill The straw needs to be replaced each year (*A M Wettach, Iowa*)

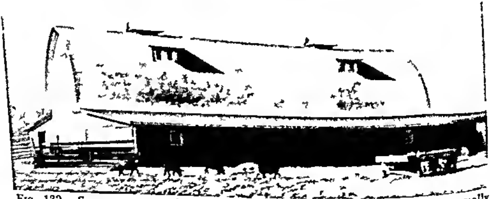


FIG 132 Some persons prefer rather elaborate structures for beef cattle especially in the Northern states This barn or shed is used for fattening cattle (*Minnesota Experiment Station*)

Providing Shelter for Young Beef Animals and Fattening Cattle. Where the practice of spring calving is followed, most of the calves brought into winter quarters are weanlings of five or more months of age Keep them separate from the cow herd so that they can be fed properly, as discussed in Chap 3 Partition off a portion of the main barn, or

provide a separate building A straw shed can be used to advantage for providing an inexpensive and satisfactory shelter One type is shown in Fig 131

Cattle being fattened for market can be kept in quarters similar to those for young stock In areas where feed lots and barns become muddy, concrete floors and paved feed lots are desirable

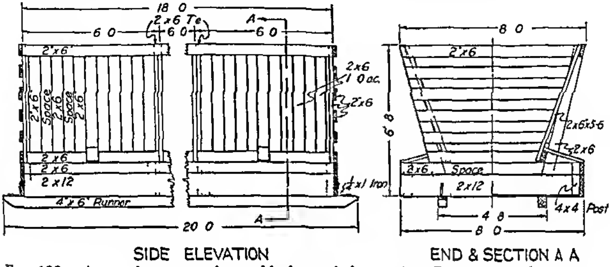


FIG 133 An outdoor type of movable hayrack for cattle By putting a board floor in it silage or grain may also be fed in this rack (*Minnesota Experiment Station*)

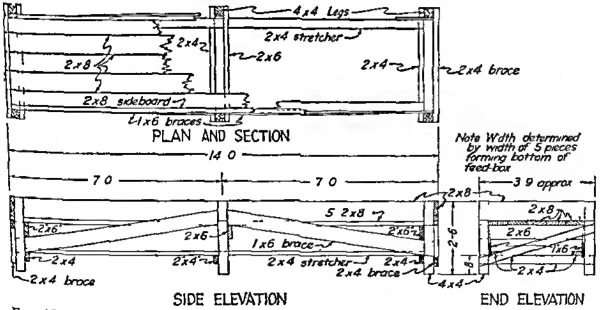


FIG 134 An outdoor type of feed bunk for feeding grain silage or cut roughage to cattle (*Minnesota Experiment Station*)

Providing Equipment for Beef Cattle Yards or corrals, feed bunks, and hayracks are the principal types of equipment needed for beef cattle Build them stout and strong Desirable types of bunks and racks are shown in Figs 133 and 134

Provide a salt box that protects the salt from the weather A central water tank is commonly used for watering beef cattle In the Northern

states equip this tank with a heating device to keep the water from freezing.

5. Providing Housing and Equipment for Sheep

Of all farm animals, sheep are best fitted by nature to withstand cold weather. In their coat of wool, they have their own natural protection

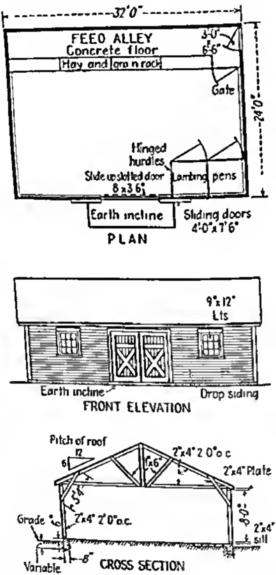


FIG 135 A one-story barn for sheep that is economical and convenient Note interior arrangement, width of doors, and other features of construction (*Minnesota Experiment Station*)

from cold. Consequently, for a considerable portion of the year, little or no housing is necessary. Even during cold weather, sheep prefer to remain out of doors, except during severe storms, if they are protected from strong winds. Thus the shelter for sheep need not be expensive or particularly warm. During the lambing season, however, provide warm quarters, as the lambs are susceptible to chilling for the first few days of their lives.

Providing Shelter for the Farm Flock. A shed-type building makes a satisfactory shelter for sheep. Construct it large enough to provide

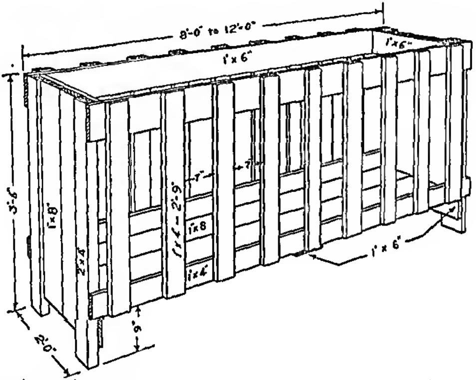


FIG. 136. A combination rack for feeding hay or grain to sheep. (*Minnesota Experiment Station.*)

15 to 20 sq. ft. of floor space per ewe. Make the doorways wide to prevent crowding and injury to pregnant ewes. Provide doors so that the building can be closed during lambing season and periods of severe storms. Allow approximately 1 sq. ft. of window space for each 20 to 30 ft. of floor space so that the interior will be reasonably light. An earthen floor is satisfactory if dry and kept well bedded.

Some flockowners prefer a gable-type building, with sufficient space overhead for storage of bedding materials, hay, and grain. This adds to the cost of the structure, but less labor is required in caring for the flock.

Providing Shelter for the Range Flock. For range flocks, shelters are needed primarily at lambing time. Central lambing quarters are

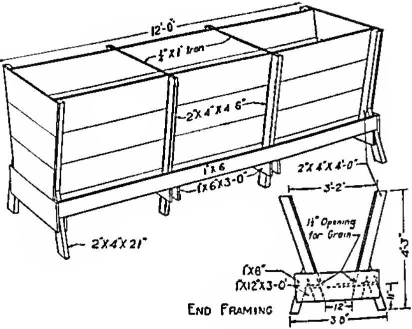


Fig. 137. A self-feeder for sheep suitable for self-feeding a mixture of cut hay and grain. (*Minnesota Experiment Station.*)

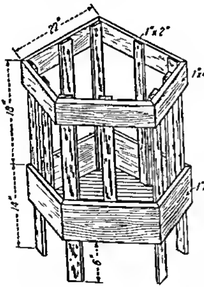


Fig 138 A low-cost, compact type of rack for feeding hay or grain to sheep This rack has space for 10 sheep (*Iowa State College.*)

frequently provided. Movable lambing equipment is used on some sheep ranches, as described in Chap. 5. For most or all of the year, the typical range flock is provided with no buildings, although some protection is frequently supplied by moving the sheep to winter ranges where the temperature is more moderate and where there is some natural shelter from intense winds.

Constructing Essential Equipment for Sheep. Sheep do not require extensive or costly equipment.

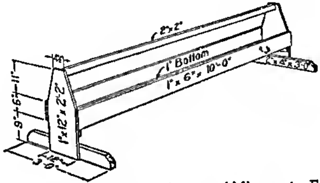


FIG. 139. A trough for feeding grain to sheep. (*Minnesota Experiment Station.*)

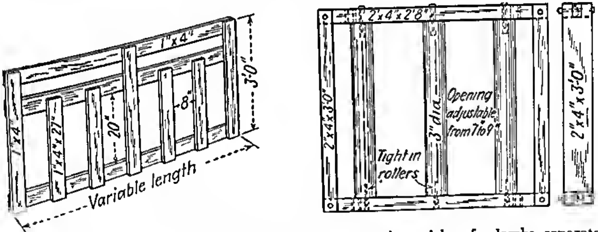


FIG. 140. A lamb creep is desirable for providing grain and hay for lambs, separate from their mothers. Two types of panels are shown that permit lambs to enter a special pen. One is made with upright slats, the other with upright rollers. (*Minnesota Experiment Station.*)

Racks for hay and fodder, troughs for grain and silage, boxes for salt, and some type of waterer are among the chief articles of equipment needed for feeding. Construct feed racks and troughs so that they will be substantial and so that feeds will not be wasted. Provide from 16 to 18 in. of feeding space for each ewe at hayracks and a similar amount at feed troughs.

For lambing pens, construct panels about 4 ft. in length, and fasten them in place in the building as needed, thus providing about 16 sq. ft.

of floor space for the ewe and lamb Some flockowners prefer to have these panels hinged together in pairs as shown in Fig 164 Use long panels, fastened together, to partition off one end of the building as a creep for lambs In one of these panels, provide several places for lambs to come and go, by properly spacing the vertical boards so that only lambs can enter, as shown in Fig 140

Construct yards near the sheep barn that will retain the sheep and keep them separated from cattle and other animals On the side of the prevailing winds in Northern states, a board fence is desirable for protecting the sheep from sharp winds in winter Some flockowners build "dog tight" yards, where the sheep are kept at night, as protection from dogs, coyotes, or wolves

6 Providing Housing and Equipment for Horses and Mules

Providing Barns for Horses and Mules For horses and mules, the chief consideration is providing quarters that are dry, comfortable, and reasonably warm In some cases, part of the general purpose barn is

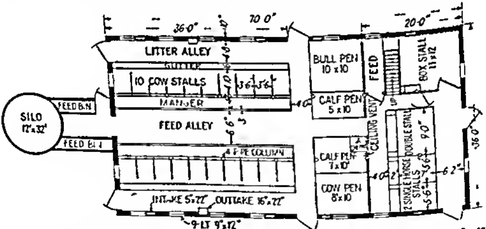


Fig 141 A floor plan for a general purpose barn with quarters for horses. Note that a solid partition separates the dairy-cattle portion from the section used by horses. (*Extension Bulletin 100, Michigan State College*)

used for housing the work animals, as shown in Figs. 111 and 141. On many farms where tractors are used, space is needed for only one team of horses at most.

Equipping and Arranging the Stable. The preferred arrangement for the stable is to have single stalls for horses or mules, with partitions between, and a feed alley in front of the mangers

Make each stall 4½ to 5½ ft. wide, depending on the size of the horse or mule. A standard length for a horse stall is 7 feet. Construct the manger with strong boards, and build a feedbox for grain at one side of the manger. Some farmers prefer cement floors for most of the barn. However, heavy planks over cement are desirable for the floors in horse stalls. Construct floors in the stalls with a slope toward the rear of about ¼ to ⅓ in. per foot.

If colts are raised, provide a box stall for the mare and colt. A standard-size stall is 12 ft. square. Be sure that it is built so that the colt will not injure itself.

Pegs for hanging harnesses are usually placed on the wall behind the horses. While this is the handiest arrangement, some prefer a separate harness room so that the harnesses can be kept clean and free from moisture.

SUPPLEMENTARY ACTIVITIES

1. Visit one or more well-equipped livestock farms or ranches in order to study the housing facilities and equipment provided for the livestock. Note the type of construction, lighting, ventilation, cost, general provisions for sanitation, and other features. Which features suggest ideas that can be used in providing facilities for your livestock projects?

2. Plan and develop suitable housing facilities for the livestock in your projects. Provide these facilities through constructing new buildings or through adapting and remodeling facilities already available.

3. Plan and construct pieces of equipment suitable for your livestock projects. Include feeders, trough, waterer, salt or mineral box, hog hurdle, lambing pen, pig or lamb creep, grain box for calf, rope halter, and the like.

4. Analyze the chore schedule for one or more enterprises on your home farm. Note carefully the routine now followed for each separate job in terms of time required and distance traveled. Improve this schedule where possible by (1) rearranging the location of feed, supplies, and small pieces of equipment, (2) constructing laborsaving equipment for removing manure and feeding, and (3) changing the chore routine to save steps and time.

5. Draw a floor plan of the barn on your home farm, showing the interior arrangement as it is at present. With advice from your father and assistance from your teacher of vocational agriculture, replan the interior as you think it should be rearranged. As a part of the planning, study the chore schedule, as suggested in the preceding activity. Wherever possible, plan the barn to shorten the time required and distance traveled

in doing chores, through changing the location of hay chutes, feed storage bins, etc Improve and relocate doors and windows, construct or repair foundations, ventilators, partitions, and other parts of the barn

6 Make a list of the articles of equipment that would be desirable for the livestock enterprises on your home farm Consider such articles as feed carts, loading chutes, corrals or yards gates, self feeders, watering devices, feed creeps for young animals racks for hay, guard rails for pigs, lambing pens, calf pens, sunshades, mangers, safety bull pen, box stalls, and others With advice from your father, choose the articles that you are to construct Decide on the plans, secure materials, and construct these articles in the school shop or at home Make repairs and improvements that seem desirable on the articles already available

5. Caring for and Handling Livestock

GOOD care of farm animals requires proper handling, grooming, and cleaning and bedding the stables; giving attention to the mother and offspring at time of birth; preparing and placing feed in feedboxes and mangers; castrating; dehorning; marking for identification; and many other miscellaneous activities that contribute to the well-being of animals. Providing proper housing, selecting feeds and figuring out rations, and maintaining health are closely related considerations; detailed attention is given to these activities in separate chapters. The following activities of major importance in caring for the daily comfort and well-being of livestock are discussed in this chapter:

1. Planning for Proper Care of Livestock
2. Caring for Hogs
3. Caring for Dairy Cattle
4. Caring for Beef Cattle
5. Caring for Sheep
6. Caring for Horses and Mules

1. Planning for Proper Care of Livestock

It has been said many times that successful livestock raising requires intelligent attention to breeding, feeding, care, and management. Every successful livestock raiser knows that failure to give proper consideration to any one of these requirements will at least prove a serious handicap to success and financial profit. On the other hand, it is not uncommon to find a farmer who is enthusiastic about the breeding practices he follows but is a poor feeder. Another may be a good feeder but fails to take advantage of his opportunity to profit from better breeding in his animals. Still another may be a good breeder and a good feeder but a poor manager and as a result fails to make money.

One of the excuses most often given by livestock raisers for a poor showing by their animals is that they did not get the "care" they should

have had Proper care of animals does require work, but it is work that will return a good wage for the time spent This is especially true if the buildings, lots, pastures, water supply, and feed supply have been arranged for convenience in doing the work of caring for the animals Intelligent planning, then, is the background for good care In fact, good care on one farm may require less daily work than poor care on another farm owing to the difference in arrangement of the buildings

FIG 142 Care of farm animals means giving attention to many details that contribute to their comfort and well being This young Iowa hog raiser finds that it pays to be on friendly terms with his hogs to supply them with plenty of feed and water and to provide sunlight or shade as needed These hogs are raised on concrete floors that are kept scrupulously clean. (*Portland Cement Association*)

equipment and planning the work as discussed in Chap 4 Much thought should be given to this feature of livestock raising, for poor care is often responsible for slow gains, heavy death losses, and low production

No animal can thrive in a filthy, uncomfortable unsanitary environment. Rough handling of animals or failure to perform such jobs as dehorning cattle at the proper age castrating young animals, docking lambs, putting rings in bulls noses and marking animals for identification causes losses that add up to a very large sum of money each year

2. Caring for Hogs

The use of the self-feeder and the automatic waterer and the raising of pigs on large fields of pasture have greatly reduced the work of the hog caretaker. It is true that the control of parasites and diseases to which hogs are subject requires a watchful eye and the taking of many precautions to protect the health of the animals besides the everyday feeding of them, as discussed in Chap. 6. Aside from the tasks of providing feed and water and cleaning quarters, important items of animal care are discussed here.

Handling and Driving Hogs. In raising hogs, it is occasionally necessary to drive them from the hog house to pasture or fields, from one pen to another, or into trucks and railroad cars for shipment. Driving a group can be a very difficult task if the hogs are frightened and overactive, but it can be accomplished with comparative ease if the correct method is used. Always handle hogs quietly and gently so that they will not be afraid of you. The most helpful piece of equipment in driving them is a small, lightweight hand hurdle 2 to 3 ft. long that can be carried. Place this hurdle in front of a stubborn or frightened hog to stop him or beside his head to turn him in the right direction when he starts to go in the wrong direction. When he finds himself confronted with such a hurdle, the hog thinks it is a fence and usually turns away from it without any hesitation. The same purpose cannot be accomplished with a whip or club. Three types of hurdles are shown in Fig. 143.

Hogs often rebel at walking up a chute into a truck or freight car. The skilled hog driver will maneuver a group until he succeeds in getting one started up the chute. An electric hog driver or prod is then the most useful instrument to help encourage the hog to proceed on up the chute. The electric hog driver is a small, rod-shaped instrument equipped with a dry cell similar to a flashlight. Instead of a lens and flashlight bulb, it ends in a blunt point, through which, when the switch is turned, sufficient electric current passes to give the animal a slight shock when touched with it. This will usually cause the hog to forget everything else in his endeavor to go forward and get away from the sting of the electric prod. Every truck driver who hauls livestock should carry one of these electric prods.

A short stick with a wide piece of belting or piece of an old inner tube about 2 ft. long attached to it has been recommended for use in

driving hogs Such a device, usually called a "pig slapper," is useful in persuading stubborn hogs to move without injuring them. A club should not be used because it injures the hogs and causes bruises that appear on the meat if the hogs are slaughtered shortly afterward

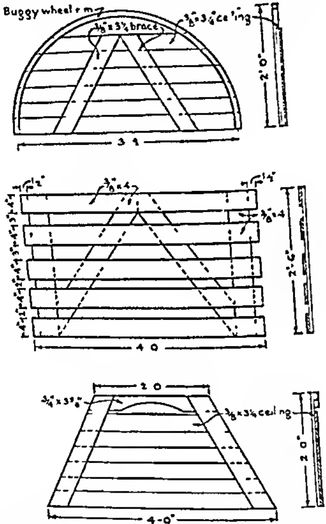


FIG 143 Three types of hand hurdles for use in driving hogs (*Farmers' Bulletin 1490 U.S Department of Agriculture*)

Catching and Holding a Hog Any hog that is wild and overactive must first be driven into a small enclosure before an attempt is made to catch it One of the simplest and easiest ways to catch and hold a large sized hog is to make a slip noose in one end of a rope of window cord size Work the noose into the mouth, and draw it tight around the upper jaw Then place the end of the rope around a partition post

and draw tight Nearly all hogs will pull back steadily on the rope This will hold their heads still while rings are put in their noses or vaccination injections are made

A small device called a "hog catcher" is now on the market It is much easier to operate than a rope It consists of a piece of strong pipe about ¾ in in diameter and 2½ ft in length A small wire cable extending from one end of the pipe is placed in the mouth and over the upper jaw just as the noose of the rope would be The loop is drawn tight by a small windlass fastened to the other end of the pipe The pipe makes it easier to get the loop into the mouth of the pig than when a rope is used An average-sized man can hold a good sized hog with this device Other types of devices effective for catching and holding hogs are also on the market

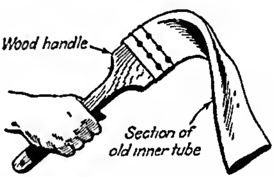
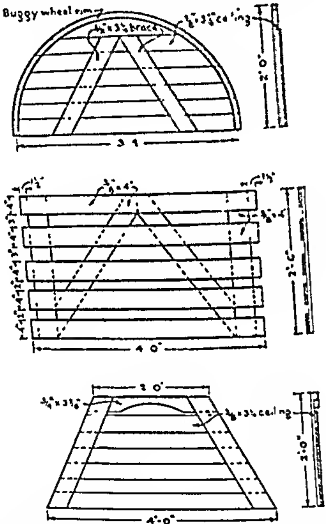


Fig 144 This simple livestock slapper will keep hogs or other livestock moving when being driven or loaded into a truck Canvas or belting can be used instead of the rubber There is no danger of bruising animals with this type of persuader (*Republic Steel Corporation*)

Caring for the Sow and Litter at Farrowing Time. Since the sow produces several offspring when she farrows and the pigs are small and easily injured during the first few days of their lives, an individual pen is needed for each sow and her litter at farrowing time and for at least 3 to 5 days following farrowing For farrowing in cold weather, the quarters need to be warm Further information on housing and equipment for farrowing is given in Chap 4

Disinfecting the Farrowing Pen If a permanent farrowing house or any building that has been occupied by hogs during the last year is to be used for farrowing, clean and disinfect it thoroughly a few days before the sows are to be put into the pens to farrow Effective cleaning and disinfecting can be accomplished only in buildings that have cement or tight board floors In cleaning and disinfecting, first remove all filth, then scrub with boiling water in which some lye has been dissolved If permanent farrowing houses are used for farrowing twice a year, even this treatment will not ensure complete safety against either parasites or diseases Steam sterilizers which generate live steam are highly effective for this job (see Fig 181) In addition, as soon as possible, place the sow and litter out in a movable hog house on clean

driving hogs. Such a device, usually called a "pig slapper," is useful in persuading stubborn hogs to move without injuring them. A club should not be used because it injures the hogs and causes bruises that appear on the meat if the hogs are slaughtered shortly afterward.



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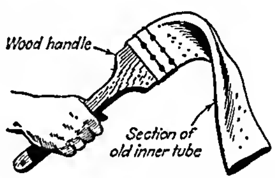

FIG. 144. This simple livestock slapper will keep hogs or other livestock moving when being driven or loaded into a truck. Canvas or belting can be used instead of the rubber. There is no danger of bruising animals with this type of persuader. (*Republic Steel Corporation.*)

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Disinfecting the Farrowing Pen. If a permanent farrowing house or any building that has been occupied by hogs during the last year is to be used for farrowing, clean and disinfect it thoroughly a few days before the sows are to be put into the pens to farrow. Effective cleaning and disinfecting can be accomplished only in buildings that have cement or tight board floors. In cleaning and disinfecting, first remove all filth, then scrub with boiling water in which some lye has been dissolved. If permanent farrowing houses are used for farrowing twice a year, even this treatment will not ensure complete safety against either parasites or diseases. Steam sterilizers which generate live steam are highly effective for this job (see Fig. 181). In addition, as soon as possible, place the sow and litter out in a movable hog house on clean

pasture that has not been used by hogs the previous year In favorable weather, move the sow and litter to this clean ground pasture when the pigs are a week to ten days old Further information on swine sanitation is given in Chap 6

Caring for Pigs Farrowed in Cold Weather If farrowing occurs in late February or early March in the Northern states, the sow and litter may need to remain in the farrowing house anywhere from 4 to 8 weeks before they can be moved to unheated houses on clean ground In this case, provide exercise for both sow and pigs Where large farrowing houses are used, this is accomplished by turning the sows out of doors into a small yard with clean, disinfected concrete floor, for an

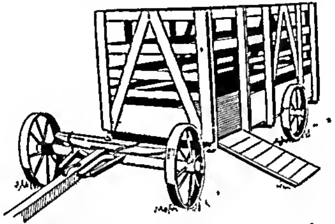

FIG 145 Large crate on wheels for moving a sow and litter of pigs to pasture (*Republic Steel Corporation*)

hour or so twice each day and turning the pigs into a central alleyway in the building Some caretakers prefer to turn sows out of the farrowing pens to feed them This is a good practice and a great help in keeping the farrowing pens clean For the little pigs, place a low trough containing water, skim milk or buttermilk in the alleyway A self feeder with a good pig ration in it placed in this alleyway aids in giving the young pigs a good start

Assisting the Sow in Farrowing To keep alive a high percentage of the pigs born an attendant must be present during the time the sow is farrowing A sow seldom has difficulty giving birth to her pigs However, she will be much less nervous and disturbed if each pig is removed from the pen as it arrives, placed in a deep box or barrel, and kept there until farrowing is completed In cold weather, fill this bo

(or barrel) half full of straw and partly cover the top. When all the pigs seem to have arrived, quietly and gently place them along the udder line of the sow to nurse. Remain with the sow until she has quieted down, nursed the pigs, and accepted them. If she appears restless and keeps getting up and down or if she shows signs of not wanting to own the pigs, it is advisable to put them back in the box, leave them for an hour, and then place them with the sow again. With a very nervous sow it may be necessary to handle the pigs in this manner for a day or two before she will own them and show signs of wanting them left with her. Many pigs have been saved by this procedure that otherwise would have been intentionally or accidentally killed by their mother.

Many little pigs die each year from starvation during the first few days of their lives. During the first few days, each pig in a litter selects a nipple and with considerable regularity nurses the same nipple until ten days to two weeks old. This makes it hard for the slower moving, weaker pigs if there are not enough nipples to go around.

Large litters can usually best be raised by dividing the litter into two groups, placing one group in a large box, and leaving the other group with the sow, leaving them for an hour, then putting them in the box, and placing the second group with the sow for an hour. This sounds like a time-consuming, tedious procedure, but it is the best way to raise large litters and save a high percentage of them. Pigs raised in this way will ordinarily begin to drink skim milk by the time they are three weeks old and should be given it to supplement the milk of the sow. By the time the pigs are five weeks old, one group can be carried along successfully on skim milk alone and the others allowed to remain with the sow until they reach a weaning age. "Artificial" or "synthetic" milk may be purchased as a commercial feed for this purpose.

If a number of sows farrow within a short period of time, it is often possible to put the extra pigs from large litters on sows that have farrowed small litters and raise them that way.

Caring for the Herd Boar. Many hog raisers follow the plan of keeping or buying a young boar each year, keeping him as a boar only until the breeding season is over, then castrating him and sending him to market. When this plan is followed, the boar is often purchased at the beginning of the breeding season, turned in with the sows on arrival, and left with them until he is sent to market. By following this plan no special care need be given him.

Housing and Handling The more efficient raisers of market hogs and breeders of purebreds prefer to retain boars to older ages, especially if their first crop of pigs indicates that they are highly successful sires The best plan for housing and handling a boar is to build him a special yard for exercise and pasture and to place in it a small movable hog house for shelter Make this pasture lot about ¼ acre in size Bank the house with straw or horse manure in winter, and it will then serve satisfactorily as a winter shelter Boars handled in this way will do better than if allowed to run with other hogs, and they can be fed according to their needs

Removing Tusks As boars reach the age of two years or more, certain teeth called tusks appear on the sides of the jaws, they grow long and sharp and are dangerous to the caretaker as well as to other animals As soon as they become long enough to be dangerous, cut them back To do this, fasten the boar securely with a snub rope around his upper jaw, and cut the tusks off with a large bolt clipper

Castrating Pigs It is essential that boar pigs to be fattened for market be castrated when young It is also essential that mature boars that have been used as sires be castrated before they are marketed for meat, for if sold as boars their meat is almost useless

Castrate boar pigs at four to six weeks old At this age, the operation of castrating is simple, and the pigs are easily held Lay the pig on its side on a table and have the four legs held securely by a helper Then grasp the purse between the forefinger and thumb of the left hand press one testicle against the skin covering it cut through the skin and membrane, and force the testicle out Draw the cord attaching the testicle out an inch or two, and if it does not break scrape it off with the knife blade Remove the other testicle similarly Wash the wound with a mild disinfectant solution[1]

Sometimes there are boar pigs that are ruptured or with only one testicle showing Unless you are accustomed to castrating such pigs secure the services of someone who is more experienced

Boars more than six months old when castrated must be thrown and securely fastened It is advisable to secure the services of a veterinarian for this task

Ringing Pigs If pigs are to be pastured place rings in their noses

[1] For more complete information on this and other methods of castrating pigs see G P Deyoe and J L Krider Raising Swine pp 276 282 McGraw Hill Book Company Inc New York 1952

in order to prevent excessive rooting. Insert the ring into the pig's nose by means of a small pincers made especially for the purpose, as shown in Fig. 146. Preferably, do not ring pigs until they are two to three months old. At this age, they can be picked up by one man and held by the forelegs while another person inserts the rings. Large hogs are held for ringing by fastening them with a snub rope or by using a special hog holder.

Trimming the Feet. An occasional boar or sow that is kept to the age of several years may develop long toes that will cause lameness if they are not trimmed. Cut back the long toes with a sharp pincers similar to those used for trimming the feet of cattle or horses, as shown

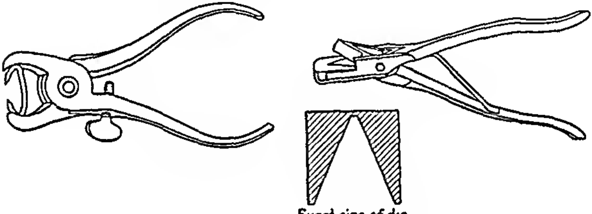

Fig. 146. Two tools needed in hog production: *left*, hog-ringing pincers; *right*, ear-notching punch.

in Fig. 174. A skillful caretaker who works quietly with his hogs can often accomplish this while the hog is lying down resting or sleeping. If it cannot be accomplished in this way, catch the hog with a snub rope, throw it, and tie by the legs until the foot trimming is done. If the foot is extremely long, use care so as not to cut into the tender, sensitive tissues. Cut off a little at a time so that you can tell when you have removed as much of the toe as possible without damage. Several trimmings may be required to bring a foot that is badly out of shape back to normal.

Marking Pigs for Identification. As with other kinds of livestock, it is necessary that purebred pigs that are to be registered be given a mark of identification. It is almost universal practice to use as an identification mark a V-shaped notch about ⅜ in. deep cut into the edge of the ear. An ear-notching punch is shown in Fig. 146. Notches located at different points on the ear and on the upper and lower edges of the ears are assigned values, and the number of the

pig is determined by adding the value of the notches together One system for numbering is shown in Fig 147

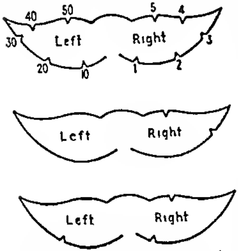

FIG 147 One system of earnotching for identifying individual pigs or litters Such a system of identification is necessary for the registration of purebred pigs and also for keeping litter weights to measure the producing ability of each sow According to the code in the top sketch the center sketch shows the number 8 and the lower sketch 26 (*Michigan State College*)

Metal eartags with numbers stamped on them may be used as identification marks for pigs An objection to metal eartags is that they may get caught in wire fencing or be torn out in other ways

Fitting Hogs for Sale or Exhibition The auction method of selling is often used by purebred swine raisers In offering breeding hogs for sale at an auction, have them reasonably fat and in a clean thrifty condition No unusual skill is required to prepare them About all that is necessary is to wash them with warm water and soap, then rub the hair with an oiled cloth the morning of sale day

Fitting for exhibition and exhibiting hogs in a show ring is more exacting in attention to minor details Although a novice may do a pretty good job at this work, working with an experienced showman is the best method of acquiring showman skill

3 Caring for Dairy Cattle

Many items in the care of dairy cattle are identical with those for the care of beef cattle Discussion of these will not be given here For information concerning them, refer to page 225 In several respects, however, the care of dairy cattle does differ materially from the care of beef cattle, owing principally to the fact that the cows must be milked twice each day and the milk must be given proper care The care of dairy cattle is discussed in the paragraphs which follow

Handling Dairy Cattle Dairy cattle are handled in closer confinement and in smaller groups than beef cattle As a result, little difficulty is experienced because of wildness among them In cold climates, cows and young calves must be stabled a good share of th

time in winter if they are to be kept comfortable. Throughout the year, cows must be brought into the barn and be tied or placed in stanchions to be milked. Under these circumstances, it will readily be seen that the caretaker must have a quiet disposition, unlimited patience, and ability to gain the confidence of the cows under his care. Milk cows with their large, heavy udders cannot walk fast and should never be hurried while being driven. When time will permit, spend a few minutes each day in brushing cows with a stiff-fibered brush.

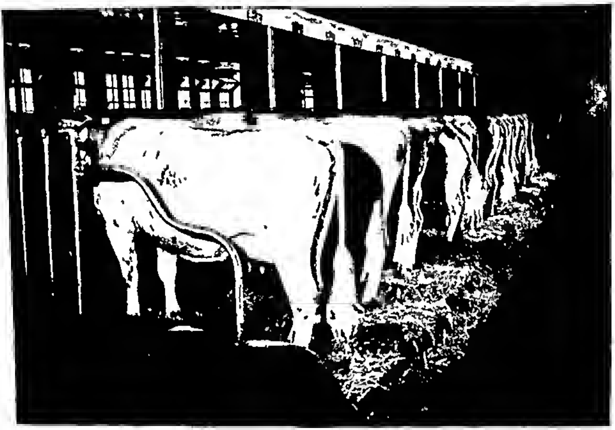

FIG 148. To produce high-quality milk, the barn should be well ventilated, light, and clean (*Michigan State College.*)

A clean stall and fresh water available at all times in a tub or supplied by automatic drinking cups add to the comfort of the cow and result in larger milk production.

Caring for the Cow and Calf at Calving Time. The dairy cow may be allowed to give birth to her calf in the pasture, but bring her to the barn soon after calving so that she may be given proper care. Most dairymen prefer that the cow calve in a box stall in the barn. Calving problems and the method of solving them are the same as for beef cows, discussed on pages 228 and 229.

Following calving, leave the dairy cow and her calf together, and

disturb them as little as possible for a few hours By that time the calf should be on its feet and show that it has nursed If the calf has not nursed within 6 hr following birth lift it to its feet, hold its nose to the teat and squeeze some milk from the teat over its nose and into its mouth It is important that the calf get the first, or colostrum, milk produced after freshening This milk differs greatly in composition from the normal milk that appears 4 to 5 days after calving The colostrum milk is laxative and contains ingredients essential to the calf Do not use the milk of the newly freshened cow for human consumption until the fifth day after calving Unless the milk appears fully normal by then postpone the use of the milk until it does appear so

Milking The newly freshened cow should have some milk drawn from each quarter of her udder within 6 to 10 hr after freshening Do not milk the udder completely dry at the time of the first few milkings This is a precaution against possible development of a case of milk fever Usually it is safe to milk the udder dry about the third or fourth day after freshening When the calf is weaned from the cow at four or five days old, the cow should be ready to take her place in the herd again and be milked along with the others

Time and Number of Milkings Each Day The common practice is to milk two times each day It is desirable that the time between milkings be divided into two periods as nearly equal as possible What usually happens in practice, particularly in northern climates where the nights are long in winter and short in summer is that in winter the time between the morning and evening milking will be 10 to 11 hr and between evening and morning milking 13 to 14 hr In summer, the situation will be reversed, the daytime being the long period and the nighttime the short period It is doubtful whether that much variation reduces total production appreciably except in heavy milking cows

Cows produce larger amounts of milk and butterfat if milked more than twice a day Under some conditions the increased production is sufficient to pay for the extra labor involved This is particularly true of high producing cows if milk prices are high and labor relatively cheap Under such conditions it may pay to milk cows producing more than 40 lb of milk per day three times in each 24 hr period and those producing more than 60 lb four times in each 24 hr period With three time milking, 5 00 A M, 1 00 P M, and 9 00 P M are the usual hours for beginning With four time milking the usual hours for beginning are 5 00 A M, 11 00 A M, 5 00 P M, and 11 00 P M

Hand Milking. Whether hand milking or machine milking is practiced, wipe off the udder and teats of the cows with a clean, moist cloth just before milking. If hand milking is practiced, use a pail with a partly closed top to aid in keeping the milk clean. Once milking is started, it is considered desirable that the milker proceed steadily and as quickly as he can. It has been demonstrated that the amount of milk a cow will produce can be increased slightly by careful and rapid milking. In hand milking, take care not to injure the teats by rough handling, by exerting extreme pressure, or by continued stripping after the udder appears to be about dry. Treat chapping, injury, or sores on the teats with a healing salve as soon as the first signs of such trouble appear. Otherwise, they are likely to become serious very quickly and interfere with the milking of the cow and thus cause her milk production to decline.

Machine Milking. The invention and development of the milking machine did much to reduce the labor required for milking. Although milking with a machine is still a tedious task, calling for close attention on the part of the caretaker, he can milk two or more cows at a time rather than one. Because machine milking draws the milk from all four teats at the same time, the milking of each cow is shortened by one-half the time required in hand milking. Many experiments have demonstrated that cows may be just as successfully milked by machine as by hand and that milk production is not reduced by using machine milking. If the machine is given proper care and kept clean, cleaner milk is usually secured by machine than by hand milking. Further information on the place of the milking machine is given in Chap. 4.

Fast Milking Methods. In recent years, a system of "fast milking," or "rapid milking," has been developed that has been adopted successfully by many farmers. This system is sometimes called "three-minute" milking because most cows when accustomed to it can be milked with a milking machine in 3 to 4 min. Some people prefer to call this "managed" milking, since the shortened time appears to be more natural for the cow than the longer time formerly thought necessary.

This method reduces the time of milking with machines as much as one-half over the usual time for machine milking. When cows become accustomed to it, they give as much milk as formerly and it seems to reduce udder ailments, which may be aggravated when the machines are left on after the udders have been milked out.

Single-unit milking machines are usually preferred in this system,

although double unit machines can be used One man working alone usually operates two of the single unit machines Two men working together can operate three single unit machines, one of them stripping the cows, weighing the milk, and carrying the milk away In all cases

FIG 149 The important steps in the fast milking system (1) prepare the udder by wiping with cloth moistened in warm water (130°F) (2) attach teat cups 1 min later, (3) leave milker attached 3 to 4 min , (4) strip by holding down on teat cups and massaging udder gently (see page 221 for further details) (*Minnesota Experiment Station*)

milking machines should be kept in good working order and operated in accordance with the manufacturer's directions

Slight variations are found in the manner in which fast or managed milking is carried out Whatever procedures are adopted, they should

be followed consistently in a herd. The main essentials or steps from which a specific plan for a herd can be developed are as follows:

1. *Prepare the cow.* Stimulate the "letdown" of milk about 1 min. before the milker is attached. This takes advantage of the fact that, once a cow's nervous system becomes adapted to a specific stimulus, she will let down her milk in 45 sec. to 1 min. after the stimulus is applied. The letdown can be stimulated by massaging the udder with the hands or by wiping it with a cloth moistened in warm water at

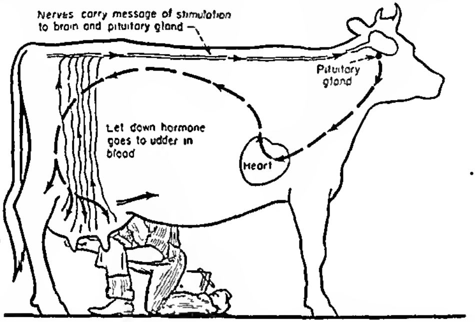

FIG. 150. Stimulating the "letdown"of milk. By applying a stimulus to the udder by means of a cloth moistened with warm water, a nerve impulse is carried to the pituitary gland at the base of the brain. This small gland releases a substance called a "hormone" into the bloodstream. The hormone is carried to the udder where it contracts the muscle cells and increases the pressure within the udder so that the milk may be removed easily and quickly. About a minute elapses from the time of applying the stimulus to the letdown of milk. (*Babson Brothers Company.*)

a temperature of 130°F. As a sanitary precaution, some prefer to add chlorine to the water at the rate of 250 parts per million (p.p.m.).

Just before attaching the milker, some dairymen prefer to make one or two full-hand squeezes from each teat into a strip cup. This aids in producing clean milk by getting rid of the first-drawn milk and helps in detecting cows giving stringy or flaky milk.

2. *Attach the milker 1 min. after preparing the cow.* Leave milker attached 3 to 4 min., or until the milk flow practically ceases.

3. *Use proper stripping methods.* Train cows to rapid stripping by hand by making a few full-hand squirts from each teat. Then change to machine stripping, which consists in holding down on the claw of

the milker with one hand and massaging each quarter with the free hand. Some operators prefer to continue with hand stripping. With either method, the stripping should be done quickly, with no attempt made to get the last drop of milk from the udder.

Before attaching the milker to another cow, dip the teat cups in water with chlorine at 250 p p m. Once a satisfactory system is worked out, follow it exactly. For further details, see Fig. 149.

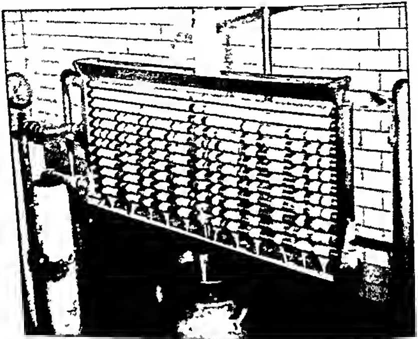

Fig 151. A surface cooler cools milk quickly to a temperature of 50°F. or lower and thus retards bacterial growth. The milk should be run over the cooler soon after milking, preferably immediately after milking each cow The type of cooler shown consists of a series of pipes through which cold water flows The milk is cooled as it flows over the surface of these pipes (*Michigan State College.*)

Caring for the Milk. In the management of large herds of dairy cattle, a specially trained dairyman is usually employed to care for and handle the milk, so that the caretaker's responsibility ends with delivery of the milk in cans to the milk room. In the small herd, however, the same person who feeds and cares for the cows does the milking and cares for the milk. In this case, two items of care are important: (1) that the milk be kept clean, (2) that it be cooled as promptly as possible and thereafter be kept cool. On some farms, the cream containing the butterfat is separated from the milk immediately following milking, the skim milk is fed to animals, and only the cream is sold.

In this case, the milk is separated before cooling, and only the cream is cooled and stored. From the average dairy farm, whether whole milk or cream is sold, it is usually delivered to a creamery or shipping station in 5- or 10-gal. cans.

Cleanliness in the milk room or separating room, thorough washing and sterilizing with boiling hot water or steam of all utensils used in connection with milking and handling the milk or cream, cooling

Fig 152 After being cooled, milk should be kept at a low temperature The storage tank shown is cooled by a mechanical unit operated by electricity (*Rural Electrification Administration*.)

promptly by setting the containers in cold water or by some other cooling device, and keeping milk or cream cold are the essential procedures in the proper care of milk. For specific equipment and suggestions on handling milk see Figs. 151 to 153.

Caring for the Dairy Herd Sire. Dairy bulls are seldom allowed to run with the cow herds. A good plan for handling a bull is to build a small barn in a location that will permit building an exercising yard connected to the barn, this in turn opening into a pasture of 1 or 2 acres fenced strongly enough to eliminate any risk of the bull breaking through the fence. By this arrangement the bull may have free run of the barn, exercising yard, and pasture without having to be led at

all. Equip the barn with a large stanchion type of manger so that whenever necessary the bull can be fastened in the stanchion to be held while being groomed or for any other purpose for which he might need to be caught Provide a breeding stall adjacent to the exercising yard so that cows may be mated without risk of injury to the caretaker.

Dehorning Calves. Since dairy calves are kept in stalls and handled daily while young, it is a simple matter to dehorn them with caustic

Fig 153 Careful washing of all dairy equipment is essential Note the electric water heater at left for providing plenty of hot water (*Rural Electrification Administration*)

This should be done because horns on mature dairy cattle are much more of a nuisance than in the case of beef cattle. For the dehorning procedure, see page 229.

Castrating Calves. If dairy calves are to be sold as veal, it is not necessary to castrate them Occasionally, a dairyman decides to keep bull calves until they are a year or more old before marketing them for meat. In this case, they should be castrated. For the castrating procedure, see page 232.

Putting a Ring in the Bull's Nose. All dairy bulls should have rings

in their noses by the time they are eighteen months old. For the procedure in putting the ring in the bull's nose, see page 232.

Trimming Feet. Very often mature dairy bulls and sometimes mature cows need to have their feet trimmed. For the procedure, see page 234.

Marking for Identification. It is especially important that dairy cows be marked for identification for the purpose of keeping milk-

FIG. 154. Two high-school students have just completed giving a demonstration on preparing a dairy heifer to go into the show ring.

production records as well as breeding records. For the method of marking for identification, see page 237.

Fitting for Sale or Exhibition. Dairy cattle are often exhibited at livestock shows. They are also sold at auction sales. Just as with beef cattle, anyone interested in this specialized work is advised to secure training and develop this skill by working with a professional herdsman.

4. Caring for Beef Cattle

Good care of beef cattle varies widely in its requirements depending upon the type of production undertaken and the climate of the locality. In warm climates, beef cattle may be cared for entirely out of doors so that fencing, corrals, a water supply, shade, and outdoor feed racks

and mangers comprise about the only equipment necessary Even in cold climates, the thick flesh covering, thick skin, and long coat of hair grown by beef cattle in cold weather give them the protection to keep warm and comfortable Inexpensively constructed buildings are satisfactory so long as the buildings protect them from snow, rain, and wind Beef cattle may be pastured in large numbers in one large field and may be housed in groups up to several hundred if ample space is provided This is true especially in handling such enterprises as raising calves in range areas, feeding groups of fattening cattle, and caring for growing cattle above the weaning age

FIG 155 Good care of beef cattle pays Shade and water along with good feed provide favorable conditions.

The items of greatest importance in the care of beef cattle are discussed in the paragraphs which follow

Handling and Driving Beef Cattle. Where beef cattle are handled in small bunches and people are around among them almost daily, the calves are easily taught to lead by the halter and older cattle may easily be driven in groups by a person on foot or horseback On the other hand, where they are raised under range conditions, run in large droves in large pastures, and seldom see a human being on foot, it is much more difficult to handle or drive them They may become wild, easily frightened, or angered when cornered

Teaching the Calf to Lead. Young beef calves can be taught to lead by the halter without much trouble if they are haltered and handled a little by the time they are six months old. The best method of leading such a calf is to use a simple rope halter. There is no method that will bring quick success in teaching a calf to lead. A good procedure is to put a halter on the calf, then tie it to the manger a few hours at a time to allow the calf to become accustomed to the halter before trying to lead it. If you take the young calf out to lead, you must have strength enough to hold it and keep it under control. After a few lessons, the calf will soon learn to walk along and respond to a light pull on the halter.

Do not try to lead even a small calf with a rope or a strap around its neck. This gives the animal too great an advantage in pitting its strength against yours, and the calf will usually win out.

Driving Wild Cattle. In range production, cattle must frequently be herded and driven, often in large droves and for long distances. In this case they are nearly always driven by a person on horseback. Saddle horses used for this work learn many tricks that are helpful to the rider. A good cowboy often becomes greatly attached to his saddle horse and takes great pride in him. Ranch owners are willing to pay a liberal price for a good, well-trained "cow horse." A good cow horse must be intelligent, quick to respond to the command of his rider, and able to run fast for at least a short distance. A good cowboy must have "cattle sense" and be mild-mannered and patient.

When for any purpose a small group of wild cattle must be driven, as in receiving a shipment of feeder animals at the local railway station and driving them to the farm, trouble may often be averted by using a "lead" animal. The lead animal can be any cow, steer, or heifer that is trained to lead readily with a halter. This animal may be led in front of the group to attract the attention of the other animals. Unless they are extremely wild or frightened, they will remain together and follow such a lead animal. In using this procedure, release the cattle from the enclosure, and then have the person with the lead animal start leading in the direction in which the group is to be driven. Have those who are to help drive the cattle spread out in more or less of a circle in an attempt to keep the group together. In driving wild cattle, it is more important to have enough helpers in front of them to keep them from breaking away than it is to have more than one person behind them to keep them moving.

Caring for the Cow and Calf at Calving Time. Normally, beef cows are mated to have calves during the early weeks of the grazing season. They are allowed to give birth to their calves out on pastures. If calving is normal, the cow will give birth to her calf and the calf will get to its feet and start nursing. In 1 to 3 days' time, it will start following its mother wherever she goes. Thus, when calving occurs out on pasture and is normal, the beef cow and calf require no extra attention.

Occasionally, there are large calves or abnormal positions of the calf, when the cow will need to be assisted in giving birth to her calf. The act of giving birth to young is slow in the cow compared with

Fig. 156. Beef cows and calves with the advantages of plenty of shade and good pasture. (*Harvey S. Woods, Illinois*)

other animals. Birth of the calf may be delayed 8 to 10 hr. after the cow first shows signs of calving and a normal calf yet be produced. If cows on pasture during the calving season are observed twice each day, those which show signs of difficult calving may be detected in time to give them necessary assistance without risk of any serious loss of calves or their mothers.

If difficult calving is due to a large-sized calf or to appearance of the rear feet and legs first, the problem is one of carefully aiding the cow by pulling on the legs of the calf to help it through the pelvic arch. This can be done by an experienced person without the service of a skilled veterinarian. In case of the appearance of rear feet and legs first, it is important that delivery be completed quickly once the hips

of the calf are through the pelvic arch of the cow; otherwise, the calf will start breathing and be quickly strangled to death. If neither the forefeet nor hind feet make their appearance in 4 or 5 hr. after the cow shows signs of calving, call a veterinarian promptly to take charge of the case.

In the management of a small herd of beef cows in a general farming area, there are usually some cows that calve out of season, often during cold weather. For the handling of such cows and their calves at calving time, the reader is referred to the discussion of the care of the dairy cow and calf at calving time on page 217.

Caring for the Herd Bull. As a rule, the beef bull is a rather mild-mannered, docile animal, easily handled by a lead ring or a permanent ring in the nose. In many instances, mating of cows is accomplished by allowing the bull to run with the cow herd during the breeding season. In large range herds, a number of bulls may be allowed to run with one large herd of cows. It is preferable whenever economically possible to separate the cows into bunches of 25 to 40 and have only one bull running with the group. Under this plan, one bull is needed for each 25 to 40 cows. A smaller number in a group is considered likely to result in a higher percentage of the cows getting in calf.

It is often preferable to keep the herd bull confined to a small pen and pasture of his own and bring the cows in to be mated, as recommended for dairy cattle breeding. Reasons for following this plan are the desire (1) to get a larger number of cows mated to one bull, (2) to have an accurate record of service dates, (3) to avoid risk of injury to a valuable sire, or (4) to avoid risk of injury to persons from an occasional vicious bull. For care of the vicious beef bull in this case, refer to the discussion of care of the bull on page 223, and follow the same general plan given there.

Dehorning Cattle. Nature provided cattle with horns, probably for their protection. In the wild state, horns are a valuable asset to cattle. Ranchers in certain range areas, where wolves, coyotes, bears, or other predatory animals are common, still prefer to leave the horns on their cattle to help protect them. The horns are considered a breed characteristic in some pure breeds. Breeders of purebred horned cattle often prefer to allow the horns to remain on their cattle.

On most ranches and in all areas of general farming, however, cattle no longer need horns to protect them. The horns are a liability and a

nuisance rather than an asset Where cattle are handled in groups, horns are undesirable because the larger, bolder cattle continually take advantage of the more timid ones by abusing them This results in considerable injury and bruising of carcasses in the shipment of cattle to market Thus, in all types of commercial cattle production, the presence of horns is considered a mark of poor management and care

Using the Dehorning Saw Horns may be removed from mature cattle with almost any kind of saw However, a saw with a narrow, fine toothed blade especially suited to the cutting of horn tissue has been devised and should be used for dehorning This saw is recommended for cattle two years old or older, for the dehorning clipper may cause injury to the head of the animal and result in its death It is also believed that bleeding stops more quickly when the saw rather than the clipper is used Dehorn with either the saw or the clipper in cool weather when flies are not prevalent If it is done when they are prevalent, the flies often deposit eggs in the hollow of the horn, where they hatch and the larvae cause serious trouble

In dehorning a mature animal with a saw, fasten the animal securely so that it cannot move its head while the operation is being performed On farms or ranches where a considerable number of cattle are produced, one of the first items of equipment that should be provided is a chute with a "cattle squeeze" at one end This device is then available to hold animals for such purposes as dehorning, vaccinating, testing for tuberculosis and Bang's disease, branding, and putting rings in the noses of bulls Such a chute is shown in Fig 158

Once the animal has been properly fastened in a such a chute, sawing off the horn is a simple operation accomplished in a few seconds' time The work can be done by anyone who has nerve and judgment enough to feel that the short period of intense pain suffered by the animal is more than offset by ridding it of the nuisance of carrying horns through out its life

In removing the horn, keep the saw blade close to the head and hold the saw at an angle so that it makes a clean, neat job and does not leave a coarse stub There will be considerable bleeding following dehorning Some bleeding will continue until the blood pressure of the animals goes down appreciably, thus allowing the clotting of the blood at the cut surface to withstand the pressure and stop the bleeding Although dehorning of mature or nearly mature animals is a severe shock to them, it seldom results in a serious setback or death of the

animal, unless some complication is encountered. Avoid dehorning in extremely cold weather, when the operation may be followed by colds or pneumonia due to the lowered resistance of the animal.

In the absence of a suitable chute for holding the cattle during dehorning, fasten the head of the animal securely to a strong, solid post.

Using the Dehorning Clipper. For dehorning young animals under two years old, the clipper is recommended in preference to the saw. The clipper is suitable for the younger cattle because the horn tissue is softer and will cut more readily under the pressure of the knife. There is less risk of injury to the head of the young animal from the use of the clipper. In using it, care must again be taken to cut the horn

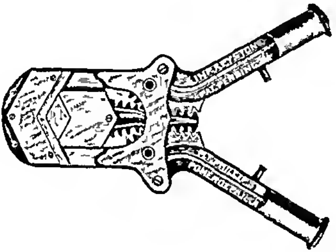

Fig. 157. A dehorning clipper for dehorning young cattle. Wooden handles are not shown.

close to the head and at an angle so that a neat job will be accomplished. A dehorning clipper is shown in Fig. 157.

Dehorning with Caustic. One of the simplest and most humane methods of dehorning is to prevent the growth of the horn on the young calf by treating the horn buttons with caustic soon after the calf is born. At that time, the embryo horn is nothing more than a callused spot on the skin. If treated at a young enough age with a chemical that destroys the young horn tissue, the horn does not develop. A stick of caustic potash is commonly used for this purpose. Preferably, use this treatment before the calf is ten days old.

Moisten the end of the caustic stick, and rub the horn button until it begins to bleed a little. Usually one application is sufficient. Observe the result of the treatment each day; if growth of the horn has not been stopped, a second treatment should be given. Handle the

caustic stick with paper or cloth wrapped around it, and use care that a drop from the end of the stick does not get into the eye of the calf or on your own clothing or skin. Caustic can blind the calf or cause a painful burn on your skin. For preservation, keep the caustic stick in an airtight bottle.

Dehorning by Other Methods. Additional methods of dehorning calves when the horns first enlarge are the use of the electric dehorner and the spoon dehorner. The first method makes use of heat to destroy the horn tissue, and the second consists of using a special instrument to gouge out the horn bud.

Castrating Calves. Castrate all bull calves that are not to be kept for breeding. If this operation is performed while the calf is two to six weeks old, it is a very simple one and involves little risk. At that age and size, the calf is easily held while the operation is being performed. Most caretakers prefer to perform the operation while the calf is standing. A helper must be on hand to hold the calf securely against a stall partition. Grasp the purse firmly in the left hand and force first one testicle and then the other against the skin on the rear of the purse. With a small sharp knife in the right hand cut through the skin, making a long enough incision so that the testicle is forced through the opening. Draw each testicle out 1 to 3 in. Sever the cord and membranes attaching it to the body by scraping with the knife or crushing them off with an emasculator, an instrument made especially for the purpose. Use cleanliness in performing the operation, and treat the wounds with a mild disinfectant solution.

In range management, it often is very inconvenient and time consuming to catch young calves, castrate them, and dehorn them with caustic. Many ranchers prefer to delay dehorning and castrating until the fall roundup, when the bull calves can still be castrated with little risk of loss and dehorning can be easily done with a clipper.

Several types of instruments are available for performing a bloodless type of castration. The most common types are used to crush or sever the cords at the top part of the scrotum. To be effective, the instrument must be used skillfully. Another method of castrating small calves is to use an "elastrator," as described under castrating lambs.

Putting a Ring in a Bull's Nose. Many beef bulls are handled throughout their lives without having rings put in their noses. As a safety measure, however, put rings in all beef bulls. Do this when the bull is sixteen to twenty four months old, as it is preferable to begin

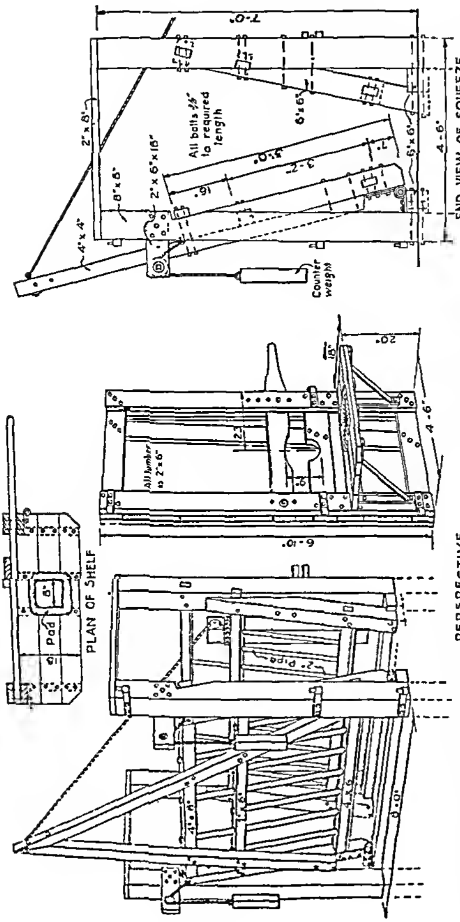

FIG. 158. A cattle squeeze made according to the illustration is recommended where large numbers of cattle not accustomed to being handled must be caught and held securely for such operations as branding, dehorning, taking blood samples for Bang's disease, testing for tuberculosis, and vaccination. *(U.S. Department of Agriculture.)*

handling him by the ring by the time he reaches that age If a young bull has been accustomed to being led by the halter, continue to put a halter on him as well as use a lead strap in his ring when teaching him to lead by the ring The nose of the bull remains tender for some weeks after the ring has been put in it By using both the halter and the lead on the ring, the bull is gradually accustomed to the use of the ring and learns to respond to the ring lead without becoming nervous and frightened or angry

Fasten the bull securely in a cattle squeeze or to a solid post before attempting the operation of ringing him Most bull rings are made so that one end of the ring when opened ends in a sharp point, which serves as a punch in putting it through the nose For other rings and

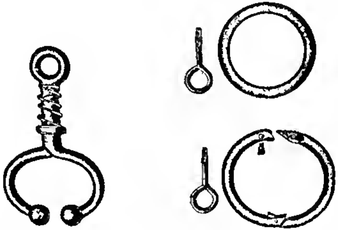

Fig 159 *Left* a cattle lead to use in leading any unruly animal *right* a self piercing bull ring

even with the self perforating type, most caretakers prefer to use a trocar and cannula or other sharp pointed instrument to punch an opening for the ring through the tough tissues Make this opening well back into the nose so that it is behind the cartilage rather than through it After the ring is inserted and the lock screw put in place, examine the ring carefully to see that there are no sharp ragged edges that will irritate the nose If a roughness is felt, smooth it off with a file or fine sandpaper

Trimming Feet. Usually the feet of cattle that are out of doors a great deal are kept worn down to normal shape and require no trimming The feet of animals that are kept indoors a great deal, while being fitted for exhibitions or sale, often grow long toes that must be trimmed off to put the feet back in normal shape Herd bulls that

are not allowed to run with the herd often grow long toes. Unless the feet are trimmed, such bulls may become useless for service.

The use of cattle stocks especially designed for holding cattle while their feet are being trimmed greatly simplifies this task and lessens the

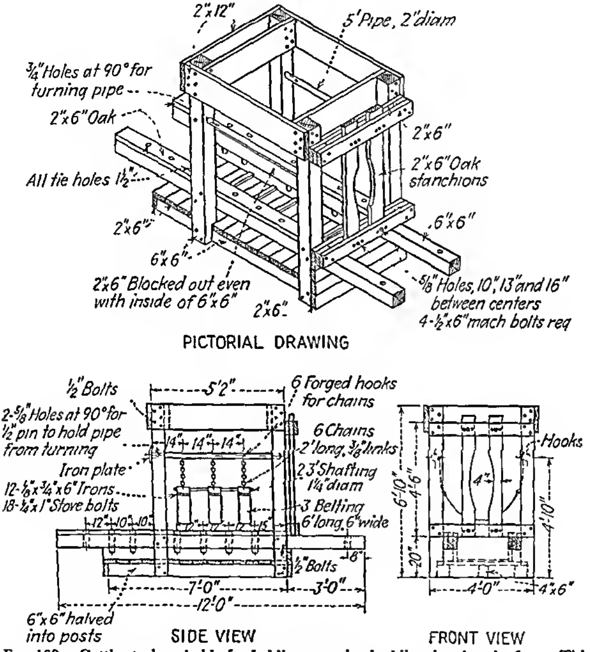

Fig. 160. Cattle stocks suitable for holding an animal while trimming the feet. This piece of equipment is especially useful on farms or ranches where purebred cattle are raised. (*Minnesota Experiment Station.*)

chance of injury to the animal. Such a stocks is shown in Fig. 160. This piece of equipment is usually needed only on purebred cattle farms where a great deal of foot trimming is likely to be required.

To hold up each rear foot of a large bull, place a pole in front of

the hock and have the foot lifted and extended by several helpers Raise each foot by placing a strap around the pastern and over the back of the animal

Another method that can be used in trimming feet is to throw the animal on a grassy spot, on soft dirt, or on a pile of straw and then fasten the legs together so that it cannot get up while the work is being done

To do the trimming, use a pair of sharp hoof pincers, a farrier's knife, or a farrier's rasp If the trimming is being done in a bull stocks, a wood chisel 1 or 1½ in wide, and a hammer or mallet are helpful in cutting off the ends of the toes Trim off the extra thick growth on the heels and the extra growth on the side walls and out over the sole of the foot Shorten the toes in order to bring the foot back to normal shape If a foot has been neglected until it has grown out of shape, two or three trimmings at intervals of several weeks may be necessary to get it back into normal shape

Marking Individual Animals for Identification. Whatever may be the type of enterprise or management plan in beef cattle raising, it is often essential and always desirable to mark animals for identification In ranching, the principal need of an identification mark is as proof of ownership In other herds, the identification mark may be needed to distinguish the individual animal from others in the herd for such purposes as registration of purebreds and keeping records of performance

Branding with a Hot Iron Where proof of ownership is the only purpose for which an identification mark is needed, the hot-iron brand on the skin over the rump or side of the animal serves more satisfactorily than any other method of marking yet devised The brand usually consists of one or two letters or a symbol burned into the skin with a hot iron The hot iron destroys the hair cells and leaves a scar on the skin, which heals Such a brand will show throughout the life of the animal and can be read from a distance of 50 ft or more by a person on foot or on horseback Should the brand become obscured by the growth of hair on either side of it, it can always be read by catching the animal and clipping the hair over the area

Before branding young calves, catch them, throw them, and fasten their legs together Apply the brand by using a blunt iron rod about ½ in in diameter, heating it to a red heat, and tracing the brand as though one were writing the figures or drawing the symbol with a

pencil (a "running" brand). The regular branding iron is shaped to the desired number or symbol; it is heated and applied as a stamp. *Avoid burning too deep.*

Older animals are usually branded by driving them through a cattle squeeze such as was described for holding animals for dehorning (page 233). Even mature animals often are branded by lassoing them, throwing them, and fastening their feet together.

Registering Brands. State governments in states in which ranching is carried on extensively maintain a registration of brands. This provides that a brand claimed, reported, accepted, and registered by a rancher must not be duplicated by any other person in that state. Anyone wishing to begin using a new brand must report the brand he expects to use to the office of the state registrar of brands and receive approval before applying it to his animals. Punishment for misuse of a brand may be by fine or imprisonment.

Using Other Ownership Identification Marks. Besides brands, several other methods are in use, largely by ranchers, to accomplish a mark of identification of ownership. Cutting loose a strip of skin on the side of the jaw or along the dewlap is one plan commonly followed. The piece of skin thus loosened forms a small, balllike growth or peculiar fingerlike projection that may serve as an ownership identification mark for the life of the animal. The tip of one or both ears may be cut off, or deep notches may be cut into the edge of the ear.

Marking Individual Animals for Keeping Records. Several methods of marking animals in breeding herds for individual identification for various kinds of record keeping are in use. Formerly, one method used for this purpose was to place a strap or chain around the neck of the animal, with a metal tag bearing a number that could be read from a distance of a few feet. This method is no longer extensively used because of its cost. Another method is to place a numbered metal tag in the ear. This, likewise, is now little used because too many of the tags get torn out and lost.

The Tattoo Mark. All purebred beef and dual-purpose cattle registry associations now require that each calf be given a herd number and that this number be tattooed in the ear. The common practice is to tattoo the initials or other letters indicating ownership in one ear and the herd number of the individual animal in the other. The tattoo mark in the ear of a young calf if carefully done with good tattoo ink will remain clearly visible throughout the life of the animal. The tattoo mark is

made with a simple instrument by which pin-point numbers or letters that have been dipped in tattoo ink are forced through the ear from the inside, where no hair grows. With a dry cloth, before the tattoo is inserted, rub clean the area of the ear that is to carry the tattoo mark.

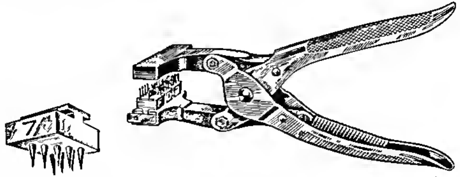

FIG. 161 A tattoo outfit for marking the inside of the ears of cattle or sheep for identification. Various combinations of numbers and letters may be used

FIG. 162 An expert on preparing a beef animal for entering the show ring demonstrates this art to a group of young stockmen (*A. M. Wettach, Iowa.*)

Secure the tattoo outfit and ink from the secretary of any of the registry associations or from almost any company that carries stockmen's supplies (see Fig. 161).

The advantages of the tattoo mark are that it is easily applied,

reasonably durable, and leaves no mark to mar the appearance of the animal. The principal objection to it is that the animal must be caught and the ear turned back and often washed or rubbed clean in order that the mark may be read.

Fitting for Sale or Exhibition. Purebred cattle to be sold as breeding stock should be well fed for a time before they are offered for sale so that they will be in good flesh when inspected by a prospective buyer. If they are to be sold at an auction, it will pay to wash them and dress them up to look their best. The same is true of animals that are to be exhibited at livestock shows. The work of preparing animals for sale or show and showing them is an art in itself. A knowledge of and skill in this art are required of very few persons and are best gained from working with an experienced showman. Anyone desirous of gaining such knowledge is advised to secure it by serving an apprenticeship with a skilled herdsman.

5. Caring for Sheep

The work of caring for sheep includes many activities similar to those required in the care of beef cattle, although the labor requirements of sheep production are low compared with those for production of other kinds of farm animals. Neglect of those tasks which need to be done results in failure in sheep raising just as quickly as in any other kind of livestock raising. For some unaccountable reason, many would-be sheep raisers have the attitude that sheep can take care of themselves, with the result that, generally speaking, the sheep is the most neglected of all farm animals in the care received. Items which the successful sheep raiser recognizes as essential to the proper care of sheep are discussed here.

Handling and Driving Sheep. Sheep, especially the fine-wool types, possess the characteristic of banding together and remaining in compact groups even when turned into the open in large numbers. Herding is the almost universal method of keeping sheep together wherever they are produced in large numbers. One herder, either on foot or on horseback, especially if he has a well-trained sheep dog with him, can easily control or drive a band of several thousand range sheep (see Fig. 163).

When sheep are handled in small groups, it is essential to work quietly and slowly. Otherwise, they will become nervous and frightened and will be very difficult to work with or drive.

Men working with small flocks, especially purebred sheep, sometimes train one sheep to lead with a small halter on its head. By taking this lead sheep ahead of the small group to be driven, the others will often follow the lead animal without being driven. Many caretakers like to have a well-trained sheep dog to follow in the rear and bring along any stragglers.

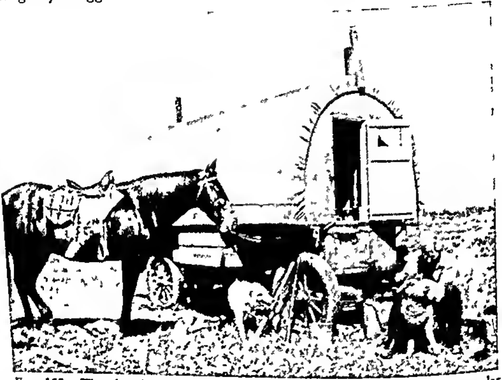

FIG. 163. The sheepherder's "home on the range" Willingness to give regular attention and work long hours, a liking for sheep, a love for the out-of-doors, and skill in working with sheep are characteristics of a good shepherd (*Western Sheep Breeding Laboratory, Dubois, Idaho, U.S Department of Agriculture*)

Catching and Holding a Sheep. It is often necessary to catch and hold an individual sheep. In doing this, be close enough to the sheep to get the left hand under the lower jaw, then quickly place the right hand on top of the head. Another way is to grasp the rear flank, thus stopping the sheep, and draw the sheep near so that the hands can be placed under the jaw and over the head. To move a sheep, as in an exhibition ring, place the left hand under the lower jaw and keep the head elevated slightly with this hand, then grasp the dock, or stub of the tail, in the right hand. The sheep is steered in the desired direction with the left hand and kept moving forward by pushing it

along with the right hand. *Never grab the sheep by the wool* to catch it or hold it by the wool after it is caught, for this pulls the skin loose from the tissues beneath and leaves an inflamed patch of flesh that requires at least 2 weeks to clear up.

Caring for the Ewe and Lamb at Lambing Time. There are two procedures commonly used in handling ewes and lambs at lambing time. These are (1) open-air or range lambing and (2) shed lambing.

Open-air or Range Lambing. In warm climates, the ewes have their lambs on the open ranges, and this is also the practice in colder climates when the ewes have their lambs after the growth of grass has started and they are on pasture at lambing time. In range lambing, the caretaker or herder keeps a close watch on the flock. He gives attention or assistance to a ewe and lamb only if the ewe has difficulty or is unable to give birth to her lamb or if the newborn lamb appears weak and unable to care for itself. In range lambing, where the ewe flock is being herded, the caretaker carries such equipment in his camp wagon as will enable him to give assistance to the ewe and young lamb if needed. He usually has several small pens that can be set up near the camp wagon in which ewes with twin lambs or with weak lambs can be cared for the first day or two. The ewe normally recuperates rapidly following lambing. The young lamb is a weak, delicate animal at time of birth; but if birth has been normal, it gains strength quickly. Usually in 1 or 2 days following lambing, both ewe and lamb are ready to go back into the flock or band and will get along without further special attention from the caretaker.

Shed Lambing. In cold climates, where the grazing season is of short duration, and in farm flock production, many sheep raisers find it to their advantage to breed ewes to lamb early in the spring before the grass has started to grow or the weather has warmed up enough to permit outdoor lambing. In this production plan, sheds must be provided for winter shelter for the ewe flock, and the ewes have their lambs in these winter shelters before being turned to pasture. It is common practice in this case to provide a number of small hurdles each composed of two light panels 3 to 4 ft. long and hinged at one corner, as shown in Fig. 164. By starting in the corner of the large shed and setting up the first hurdle so that the end and the side of the shed form two sides of a small pen, a row of such pens is provided. The side of the shed forms the rear wall of each pen, and the side of

the previous hurdle forms another side. In small flocks, you may wish to put ewes into the small pens a day or two before they lamb. In large flocks, allow the ewes to lamb, then place each ewe and her lamb or lambs in one of the small pens for 1 to 3 days or until the ewes and lambs are in normal condition and ready to go into a larger group (see Fig. 165).

After a part of the ewes have lambed, arrange a temporary partition across the end of the shed. As the ewes and lambs are ready to run together in a group, place them in this smaller section of the shed. In this way, only ewes with lambs will be running together. As more

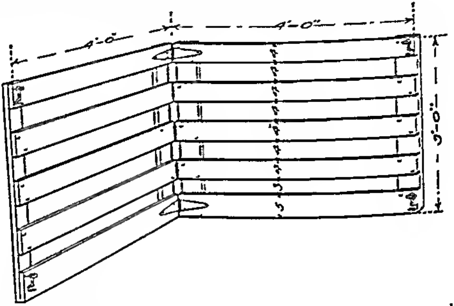

Fig. 164 A hinged panel for making temporary lambing pens in a sheep barn. (*Farmer's Bulletin 810, U.S. Department of Agriculture.*)

ewes have lambs, move the temporary partition to increase the space for them. In this way, ewes with lambs are kept separate from those not yet lambed. Some caretakers prefer to have two groups of ewes and lambs, one for the ewes with twin lambs and one for ewes with single lambs so that ewes with twins can be fed larger amounts of grain. Further information on housing and equipment for sheep is given in Chap. 4.

Many items of work, each requiring only a minute or two, are of sufficient importance that whether they are done or not may mean the difference between saving the life of the lamb or losing it. Among these items, the first is assisting the ewe to give birth to her lamb.

How to do this successfully must be learned by experience or by observation of someone else skilled in the work.

Many young lambs that would otherwise die can be saved by such simple procedures as trimming the wool away from around the udder and teats of the ewe so that the lamb can find the teats readily and not spend time sucking a tag end of wool instead of a teat. Allowing the tag ends of wool to remain about the udder of the ewe often results in the lamb pulling out the wool and finally swallowing enough to cause death from a wool ball in the digestive tract.

Many lambs that appear weak at birth will gain strength rapidly

FIG 165 Two ewes and their lambs, quiet and comfortable, in their lambing pens where they were placed just after the lambs were born (*A M Wettach, Iowa*)

if they are helped to nurse the first time or two. There are occasional ewes that refuse to allow their lambs to nurse. Tie such a ewe to the partition, and hold her each time her lamb nurses, until she shows signs of accepting the lamb and mothering it rather than abusing it.

Sometimes, immediately after lambing, ewes are affected with swollen, caked udders The best treatment in this case is to bathe the udder for 5 min. with water that is about as hot as the hand can stand for ½ min. It is sometimes necessary to milk part of the milk from the udder, also.

Often, young lambs will be constipated, and unless they are given a laxative they may die. Give such a lamb 2 tablespoonfuls of mineral oil.

Caring for the Flock Sire. Most breeds of sheep mate only in the fall and early winter As a result, the ram may be allowed to run with the flock throughout the year and the ewes will be mated at about the time desired One exception is that in northern climates if the sire is allowed to run with the flock the ewes may be mated earlier in the season than is desired so that the lambs will be dropped in late winter or early spring, while the weather is still cold For this reason, remove rams from the breeding flock by Aug 1, and turn them back at whatever date it is desired that the mating begin

In large flocks, particularly, keep the rams separate from the ewes throughout the year except during the breeding season Feed them properly so that they will be in good breeding condition at the beginning of the breeding season If a number of rams are turned in with a large number of ewes through the breeding season, have one ram to each 40 ewes

In handling a purebred flock, in order that the breeding record may be kept divide the ewes into small groups and turn only one ram with each group Many sheep caretakers prefer to keep the rams in the sheepshed during the day and turn them in with the flock at night only Rams so handled can be fed properly, and this along with the rest period through the day helps to keep them in better condition through the breeding season

Many caretakers mark the breast, or brisket, of the ram with a nonpoisonous coloring material so that the ewes will be marked on the rump when they are bred This practice keeps the caretaker informed on how the mating of the flock is progressing and whether the ewes are being settled by the ram or not, as discussed in Chap 7

Docking Lambs. No one has yet determined why nature endowed the lamb with a long tail for which there seems to be no use whatever Long tails are a handicap to sheep throughout their lives As a result, the practice of docking, or cutting off, the tail of the young lamb to leave only a short stub 1 to 2 in long is a universal practice wherever sheep are raised The operation of removing the tail is simple, gives the lamb comparatively little pain, and if carefully done at a young age seldom results in the loss of the life of the lamb

Preferably, dock all lambs when they are three to eight days old Remove the tail about 1½ in from the body One method is to cut it off with a sharp knife, and treat the wound with a mild disinfectant To reduce bleeding, apply pressure to the stub with the forefingers and

thumbs. There is occasionally excessive bleeding, especially in lambs not docked until more than two weeks old. If so, check the bleeding by tying a string tightly around the stub of the tail close to the cut end. Remove this string after it has been on 8 to 10 hr.

Many sheepmen prefer to use a pair of docking shears or a docking iron heated to almost a red heat. The heated metal sears, or cauterizes, the cut surface, causing the arteries to close quickly, and thus prevents excessive bleeding. Lambs may be docked by using a castration emasculator, which crushes rather than cuts the tissues and thus helps to prevent bleeding. Another method is to use the special elastrator described under the section on castrating lambs. Lambs several months old are sometimes docked by using a special instrument called the "Burdizzo." This instrument separates all tissues except the outside thin, tough skin. Following its use, the thin skin holding the tail

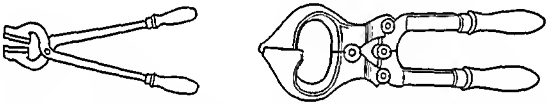

FIG 166. Two types of docking instruments for docking lambs: *left*, docking pincers, which are heated to near red heat before using; *right*, a Burdizzo instrument, which may be used for docking or castrating large lambs.

separates, and the tail drops off. Use of the Burdizzo is recommended only for docking lambs so large that usual docking methods are likely to result in excessive bleeding and death (see Fig. 166).

Castrating Lambs. All ram lambs that are not to be retained for use as sires should be castrated when two to four weeks old. To castrate the lamb, cut off the end of the purse, force the testicles out one at a time, and pull each free by pressing near the body with one hand and grasping the testicle firmly and pulling with the other hand. Special castrating shears may be used instead of the knife. Wash the wound with a mild disinfectant solution.

A bloodless method of castrating is done with a special instrument called an "elastrator" which is used to place a special rubber ring tightly around the top part of the scrotum above the testicles. The same instrument may be used for docking by placing the rubber ring around the base of the tail. This causes the scrotum or tail to atrophy and drop off in 2 to 3 weeks.

Trimming the Feet of Sheep. Mature sheep often grow long toes that interfere with their walking and may cause serious lameness. The wall and toe of the foot of the sheep are so small that they can be trimmed with a strong, sharp pocketknife. In purebred flocks, especially, look over the feet of the flock about twice a year and trim those which need it. It is especially important to examine the feet of flock sires a few weeks before the beginning of the breeding season and trim those which need it. Do this early so that if the trimming leaves the feet tender they will have time to toughen before the beginning of the breeding season.

Shearing Sheep. Formerly, sheep were shorn with a hand shears. This was a slow, tedious, backbreaking task. Shearing was simplified, speeded up, and made much less of an ordeal for the sheep by the invention of power shearing outfits. The shearing machine operates on the same principle as the hair clipper used by barbers. Shearing machines may be individual, one-unit outfits or large, multiple-unit outfits such as are used on large ranches.

Most sheep shearing is done by specialists experienced in this work. Even in areas where the farm flocks are small and scattered, it is often possible to secure the services of a skilled shearer who proceeds from one flock to the next, staying at one place as long as it takes to shear the sheep. These men usually have their own shearing machine, a one- or two-unit outfit operated by a small gasoline engine or electric motor. They charge a fee on the per head basis, usually 25 to 50 cents, depending on the going price of wool and prevailing wage standards in other types of work. By working fairly long hours, the expert shearer can earn good wages through the shearing season, and the sheep owner still finds it cheaper to hire his sheep shorn by a specialist rather than trying to do it himself or having it done with inexperienced labor. Suggestions on shearing in order to secure fleeces in good condition are given in Chap. 9.

A beginner desirous of learning to shear sheep should work with an experienced shearer until he knows the procedure and then develop further skill by experience and practice.

Preparing Wool for Marketing. In farm flocks, fold and tie each fleece as it is removed from the sheep. First lay the fleece on a clean floor or table, cut surface down. Then turn in the edges and fold over from each side until a strip about 15 in. wide results. Roll tightly, starting from the head end. When rolling is completed, the fleece will

be in the shape of a bundle more or less resembling a cube 12 to 18 in. in size, as shown in Fig. 168. Tie it with a special type of paper twine for wool, using just enough twine to hold the fleece together. Do not use binder twine. Then pack the fleeces in large burlap bags for

FIG 167. Shearing a sheep requires considerable skill, which can only be developed with proper instruction and practice. (*Minnesota Experiment Station*)

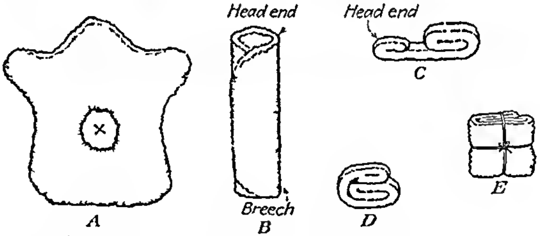

FIG. 168 One method of rolling and tying a fleece of wool, steps are shown in sequence (*Minnesota Experiment Station*)

transportation to market. Some bags hold 25 to 50 fleeces, or about 250 lb. of wool. Wool marketed in this way is later unpacked, sorted, and graded. Further suggestions on methods to use in preparing wool for the market are given in Chap. 9.

On ranches or wherever large numbers of sheep are shorn, the wool

is usually sorted and graded as it is shorn, then bagged or baled into bales similar to those for cotton for shipment to market.

Marking for Identification. Marking for identification of ownership is not so important in sheep as in cattle ranching, for there is not the same opportunity for sheep to stray away or be stolen. Many ranchers, however, mark their lambs by cutting off the tip of one or both ears. By making the cut carefully at a certain angle or making an irregular cut, this method of marking is simple to accomplish, permanent, and easy to see.

Marking that will last up to about a year is sometimes accomplished by stamping a brand symbol, letters, or numbers on the wool over the back. For this purpose, use a large stamp with a surface that will absorb and hold the coloring paint. Use liquids for this purpose that are nonpoisonous and not injurious to the wool instead

FIG. 169. Three methods of marking sheep for identification: (*a*) metal eartag, (*b*) ear notching, (*c*) tattoo (*Farmers' Bulletin 810, U S Department of Agriculture.*)

of white lead paints. Such a brand is often used just before sending a large shipment of lambs to market in order to avoid any question concerning identification at the market. The brand, of course, is lost when the sheep is shorn. This type of brand is often used by experiment stations for identification of individual sheep in breeding or feeding experiments where identification of individual animals with a mark that can easily be read is needed. For this purpose numbers are used. This is called a "wool brand."

For flock improvement, each ewe should carry a separate identification mark. A commonly used mark of identification of individual sheep and the one used by all purebred registry associations is the metal eartag with letters indicating ownership or breed identification stamped on one side and a number to identify the individual sheep on the other side. The metal tags are inserted by cutting a small hole in the ear with a punch made for the purpose. The open label is then

inserted and clamped shut. Additional suggestions for methods of marking sheep for identification are shown in Fig. 169.

Fitting for Sale or Exhibition. Fitting and exhibiting sheep, like fitting and exhibiting cattle, constitute arts in themselves. In general, success in showing depends upon having sheep good enough in breeding to start with, then feeding them properly, "blocking" the fleeces by trimming with hand shears, and training the sheep to stand and pose correctly. Many practices have been used by professional shepherds to produce an attractive appearance in their sheep. Among

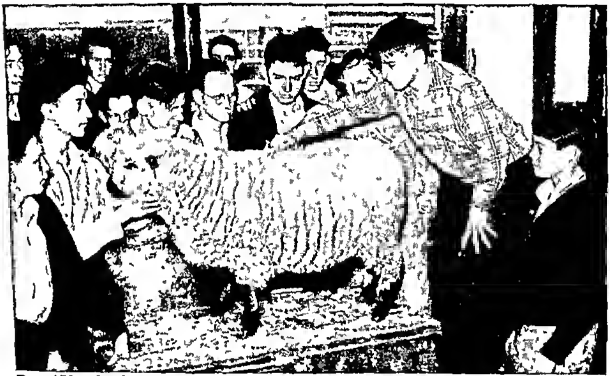

FIG 170. Students of vocational agriculture at Noble, Okla, under the direction of their agricultural teacher learn to trim or block a sheep for the show ring. (*Edd Lemons, Oklahoma*)

these may be mentioned washing the fleece some weeks before the exhibition, then blanketing the sheep to keep the surface of the fleece clean and fresh in appearance. In some breeds, the fleece is sometimes colored to give it an unnatural but striking appearance.

In all medium-wool breeds, it is common practice to block sheep for exhibition. It would be difficult to discourage this practice because it does improve the outward appearance of a sheep greatly. However, it does not deceive the competent judge as to the true form or merit of the animal. Such practices as coloring of the wool should be discouraged. Blocking a sheep is an art that may be learned best by observing one skilled in it, then practicing until the art is mastered.

6. Caring for Horses and Mules

Because horses and mules serve man by doing work, their value depends largely on how long they live and remain sound and healthy. Their useful life span depends largely on the care they receive. Horses and mules are usually handled and stabled as individuals rather than in groups. Daily care and feeding are required throughout the year. This method of care makes it possible to meet the needs of each animal according to the kind and amount of work it is doing.

Because horses and mules are handled individually and because they must be groomed and harnessed or saddled, then driven or ridden, the contact of the caretaker with them is much more intimate than is the case in caring for other kinds of farm animals. Colts that are raised on farms where they are haltered and handled throughout their lives usually develop quiet, docile dispositions. Even under these circumstances, there are occasionally some with nervous dispositions that are easily frightened and some that are vicious. Horses that grow up in large groups and are seldom haltered or handled do not take kindly to the first training lessons when they are being taught to lead, to drive, or to ride. Important items in the care of horses and mules are discussed below.

Using Safety Precautions in Handling Horses and Mules. Safety to himself should be the first consideration of the horse or mule caretaker. Horses and mules are large animals. They are quick in action. As a result of this combination of characteristics, the first lesson in horsemanship must be that the caretaker learn to practice every precaution to avoid injury to himself. In approaching a horse or a mule in a stall, attract his attention by speaking to him before starting to groom, harness, or saddle him. If a horse or mule is taken by surprise and suddenly sees an object approaching without knowing what it is, his natural reaction is to kick.

Leading a Horse. In leading a lively spirited horse out of a stall, use a bridle or at least a lead bit attached to the halter. The end of the lead rein is then passed through the ring in the bit on the left side and fastened to the bit ring on the right side. Lead the horse from the left side so that the right hand is nearest the animal. Walk beside the animal's head rather than in front of him. The use of the bit in the mouth and the "curb lead" is the most effective method of controlling a horse in leading him.

Hitching Horses or Mules. In hitching a spirited team, fasten the lines to the bits first, then fasten the breast straps to the neckyoke. Put the tongue in place in the neckyoke ring. Hold the lines in the left hand, allowing them to run through the hand as you walk to the rear of the team and begin hitching the traces, or "tugs." Either keep the lines in the left hand or lay them over the side of one of the horses so that they can be reached if the team should start before all the traces are hitched. In unhitching, unfasten the traces first, then unfasten the breast straps from the neckyoke. Unfasten the lines from the bits, and tie them on the hames last.

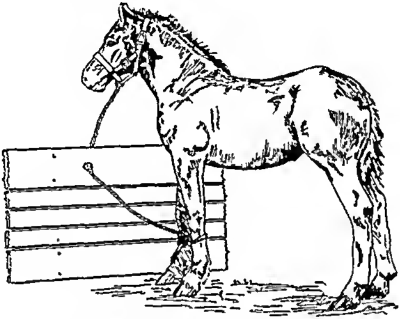

FIG 171. Among the first lessons for a colt is getting used to a halter and to being tied Illustrated is one method of training an unruly colt or older horse to stand quietly when tied (*Extension Service, Michigan State College.*)

Repair or replace worn bits or lines before there is danger of their breaking. Neglecting to take the above precautions has resulted in serious injury or death to many persons while handling horses or mules.

Breaking a Young Horse to Work. Breaking a young horse to work or to ride will be a simple or a trying task depending on the breeding and natural disposition of the animal and the manner in which it was raised. The average farm colt of the draft breeds that has been stabled in winter and handled by the halter each year of its life can usually be taught to work with very little effort. Large, well-developed colts may be used for light work when two years old. Most horsemen prefer to wait until the colt is three years old before starting it to work.

A procedure that will usually accomplish the desired result is to put a collar and harness and bridle on the colt, then let it stand in the stall several hours to become accustomed to the bit and the harness. After repeating this several times, take the colt outdoors, and lead it around by the bridle to become accustomed to having the harness on outdoors. Then hitch it beside a horse of quiet disposition, using a neckyoke. If the colt shows signs of undue fright or resentment, tie its halter rope to the hame ring of the older horse. Also, put a separate rope on the bridle, which is handled by a helper who walks beside the colt until it becomes accustomed to driving as it should and responds to the lines. Using this lead rope for the first two or three lessons in driving often averts a tangle and also speeds up the educating process. The team is then ready to be hitched to a wagon so that the colt may become accustomed to the pull on the traces. Keep loads light until the colt learns how to pull.

Horses that have been raised on the range and have never been handled with a halter will require greater care, more time, and sometimes more severe methods in training them to work. In this case, training had better be turned over to an experienced horseman who knows all the tricks of handling and breaking unruly horses.

Fitting and Adjusting Harness. The most important part of a harness is the collar. Regardless of what the remainder of the harness is like, a well made, properly fitted collar must be provided if the horse is to work comfortably and effectively and avoid sore shoulders or neck. A collar must be wide enough to prevent pinching against the side of the neck, but it must not be too wide. It must be long enough so that it will not interfere with breathing, but not too long. Failure to fit in any one respect will result in discomfort to the horse; if the misfit is bad enough, sores will result, a condition that will cause the animal great pain and will soon render him at least temporarily useless. Once a horse has suffered from a severe shoulder or neck sore, the region where the sore was located will very easily become sore again because of the weakening of the tissues in the area.

Often a collar that fits in the spring of the year will be too large by midsummer, owing to loss of fat and weight in the horse. Such a collar can often be used satisfactorily if a sweat pad of proper thickness is placed under it. Likewise, a collar that fits in midsummer may be too small late in the fall or winter after the horse gains weight and flesh again. It is important also that hames fit the collar properly

They must be long enough and not too long. They must be drawn tight enough together at the top of the neck and not too tight. They must be drawn tight enough at the bottom so that they fit the collar firmly. How to tell when a collar and hames fit properly is easily demonstrated but difficult to describe. Observe closely whether the horse seems to be working in harness comfortably or not. This is the best guide that can be used to determine whether or not a proper fit has been secured.

There are many types of harness for different purposes. See that all harness straps are properly adjusted to the length most comfortable to the horse. Adjust lines so that they draw evenly on the bits of all horses in the hitch.

There are also many types of bits. Some horses seem to be much more sensitive about the mouth than others. Tender-mouthed horses drive best with smooth, straight bits, while hardmouthed ones may need a more severe bit. Several different types of bits may need to be tried out in selecting the type best suited to a horse that is troublesome to drive. Examine harness, lines, and bits frequently, and keep them in good repair as a safety precaution.

Caring for the Brood Mare and Foal. Farm work horses or mules frequently may be produced at lowest cost on the farms on which they are to be used for work. This requires the raising of one to several colts on many farms each year rather than the raising of horses in large numbers on specialized horse-producing farms. The task of caring for the brood mare and foal is, therefore, a common one on many farms.

Success in handling the brood mare at foaling time will be simplified if the mare is mated to foal after the grazing season has begun and is allowed to run on pasture several weeks before and after foaling. This means allowing the mare to remain idle during an important part of the work season and on that account greatly increases the cost of raising the colt. Many farmers prefer to mate mares to foal in the early spring so that they will be ready to take their place as work horses when the spring work begins. In this case, foaling occurs while the weather is still cold and conditions are not suited for outdoor foaling.

Successful indoor foaling requires that a roomy, clean, well-bedded box stall be available. Provide a stall that is at least 12 by 12 ft. in dimensions. As foaling time approaches, place the mare in the box

stall at night, and watch her closely. Unlike parturition in the cow, ewe, or sow, foaling in the mare is rapid and occurs soon after the appearance of the first signs that the mare is to give birth to her colt. In cases of difficult birth because the colt is large or appears rear feet and legs first, give assistance promptly; otherwise, the colt will be dead at birth. In case of an abnormal position of the foal, secure the service of a skilled veterinarian at the earliest possible moment. Six to eight hours' delay in delivery of the colt, after labor pains begin, usually results in the death of the colt and often of the mare.

FIG 172. Brood mares and their colts should be turned to pasture at night and when the mares are not working (*A. M Wettach, Iowa*)

Following birth, break or cut the navel cord of the colt about 2 in. from its body. Treat the stub of the cord, preferably with a dry disinfectant powder, though tincture of iodine or any moderately strong disinfectant solution may be used instead of the powder. Observe the navel cord closely at intervals of several hours to see that it is not bleeding excessively. If bleeding is excessive, tie a string around the stub of the cord and leave it in place for several hours to check the bleeding.

The average colt has sufficient strength to get on its feet and nurse within 2 hr. after it is born. If it is unable to do so, assist it to its feet and help it find the teat. Some colts are so weak that they will not attempt to nurse when handled in that way. It is worth while then

to get a bottle and nipple, milk some milk from the mare, and try to get the colt to take it from the bottle. Occasionally, a weak colt can be coaxed to live in this way; but if the colt is too weak to nurse when held on its feet, the chances are that it will die by the time it is a few hours old.

Young colts are often constipated the first day or two. The most successful treatment of this condition is by the use of an enema. In giving the enema, use a quart of lukewarm water.

So long as the mare and colt are progressing normally, the less they are disturbed during the first 2 days of the life of the colt, the better they will get along. By the time the colt is three to five days old, turn both mare and colt outdoors into a barnyard by themselves for at least a short time, to get some exercise. From this point on, it is important that in some way both get some exercise each day as long as the weather is not too severe for the young colt to be out of doors.

A brood mare that is badly needed as a work horse may be put to work by the time her colt is two weeks old. It is advisable to leave the colt in the box stall in the barn while the mare is at work. As soon as pasture is suitable, turn the mare and colt to pasture overnight. Both mare and colt will benefit from the grass, and the colt especially will benefit from the exercise.

On every farm, there will be some horses that are not raising colts. Use them for the heaviest work, and favor the brood mare as much as possible with light work. A mare can raise a colt and do almost a full season's work if properly and carefully handled and well fed. Wean the colts when they are 4½ to 6 months old. They should be receiving a light feed of grain twice a day before they are weaned. Continue this grain feeding until the colt is at least a year old.

Caring for the Stallion. Stallions are maintained on comparatively few farms. They must be maintained on some farms for stallion service to be available. A farmer who likes to work with horses will find that the stallion enterprise pays dividends in several ways.

Some farmers prefer to handle and use the stallion as a work horse. This is one of the most profitable methods of stallion management. Under this method, the stallion is trained to work when two or three years old and is handled and cared for just as the other work horses are cared for. The only special care required will be that a separate yard with a high fence around it be provided for him into which he may be turned for exercise. Stallions cannot be turned out to exercise

with other horses because they will fight them and injuries will result

Some stallion owners prefer not to work the stallion In this case, it is advisable to have a small barn connected with a pasture lot of 1 to 2 acres into which he can run at will throughout the year A large box stall in the regular barn may be used and the pasture lot located conveniently to the barn This requires the daily task of turning the stallion into the exercising yard and getting him in the barn again once or twice each day If the stallion is handled in this manner and not worked, special care must be taken to trim his feet regularly and give him enough grooming to keep his skin and hair in shape, especially about the legs

In this management plan, the stallion is often traveled by leading him or hauling him in a truck over a route covering considerable distances Usually one or two day stops are made at farms on which the farmer has several mares he wishes to have mated For that reason, he is willing to have the stallion brought to his place and will incur the inconvenience of providing housing and feed for the stallion and room and board for the man in charge Handled in this way, the stallion must be a good one for which a liberal service fee may be charged, otherwise the enterprise will not prove profitable to the owner A good, mature stallion, properly cared for, may mate 100 to 125 mares during the breeding season and can be expected to get about 60 per cent of them in foal

Caring for a Jack In mule breeding areas, jacks are cared for much the same as stallions except that they do not make suitable work animals and cannot be successfully traveled over a breeding route They must be kept in quarters with which they are familiar, otherwise, their use as sires will not be successful A jack cannot be used to mate as many mares as a stallion It is not advisable to try to mate more than 60 to 75 mares to a mature jack during a season He should get 60 to 75 per cent of them in foal

Grooming Growing colts and idle horses and mules are usually not groomed Any horse at work requires a limited amount of grooming to keep its appearance presentable Horses sweat, and their wet hair takes up dust readily A sharp toothed currycomb may be needed to loosen heavy accumulation of sweat and dust or dried mud about the legs Use such a comb lightly and carefully so as not to irritate the skin too severely Do most of the grooming with a stiff fibered brush

Caring for the Feet The horse has been endowed by nature with the toughest, most durable type of foot possessed by any animal The feet of the young growing colt often need trimming to keep them developing normally For this reason, observe the feet of the growing

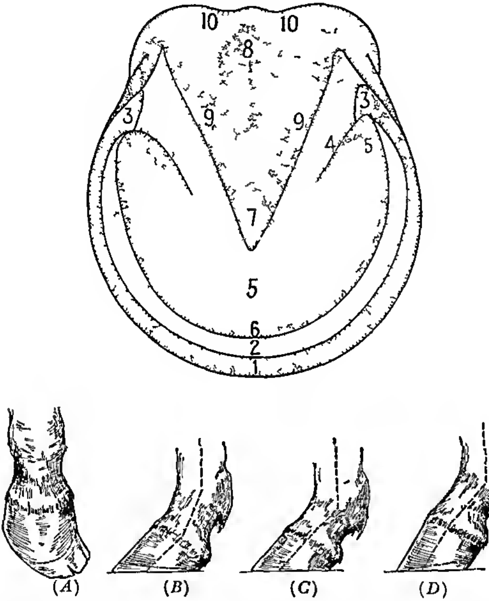

Fig 173 *Above* a healthy well trimmed foot with parts numbered (1) wall (2) leaves of the wall, (3) heel, (4) bar, (5) sole, (6) white line, (7) point of frog (9) side cleft of frog and (10) bulb of heel *Bottom* (*A*) crooked toe (*B*) long toe (*C*) normal foot properly trimmed (*D*) foot high at the heel (*Michigan State College*)

colt carefully every 3 to 4 months, and trim if necessary The hoof wall grows from the top down and often grows out beyond the sole The only trimming required is to keep the outside wall cut back to the level of the sole For trimming, use a strong, sharp pincers, and fol

low with a coarse rasp to level up the cut surface after trimming with the pincers is completed.

Horses used regularly on hard-surfaced roads must be shod with iron shoes, as the hoof will not long stand such wear. The hoof continues to produce new growth throughout the life of the horse, but it cannot produce new growth as fast as it is worn down on hard surfaces. Although anyone can easily learn how to shoe a horse, it has always been common practice to have shoeing done by men who make a business of doing this work. So long as such men are available, it is preferable to hire shoeing done. Shoes need to be reset every 6 to 8 weeks. The life of the shoe itself will depend on the kind of roads and the quality of the shoe. Most shoes can be reset only once or twice and will then need to be replaced by new ones.

Fig 174 Hoof parers suitable for trimming the feet of horses or cattle

Fig 175 Horses used regularly on hard-surfaced roads must be properly shod. Here the village blacksmiths do the work (*Animal Husbandry Department, Michigan State College*)

Caring for the Teeth. The teeth are an occasional source of trouble in horses and mules In growing colts, the trouble may be temporary, owing to the process of replacement of the foal teeth by the permanent ones. The teeth of young horses seldom require any special care. An

occasional decayed or ulcerated tooth may become painful to the horse and need to be extracted. Failure to eat normally should be taken as a probable symptom of tooth trouble. The teeth of older horses occasionally wear unevenly and develop sharp edges that may cut the tongue or cheeks. This condition is remedied by having the sharp edges filed away. The veterinarian has special instruments for this purpose and should be called in to do this work.

Fitting for Sale or Exhibition. The horse on exhibition has always been the most attractive to spectators of all the farm animals. This is especially true of the light types exhibited while hitched to vehicles or under the saddle. Preparation of such horses for exhibition or racing is a highly specialized kind of work.

The auction sale is a popular method of selling horses of all kinds. Preparation for sale is much less exacting than preparation for exhibition. It requires principally that horses be put in good condition of flesh by proper feeding and that they be presented in the sale ring in clean, sound condition.

A novice may easily acquire familiarity with the requirements for exhibiting draft horses by a brief period of working with an experienced showman.

SUPPLEMENTARY ACTIVITIES

1. Visit a farm or ranch of a good livestock producer, and observe the methods used in caring for the various kinds of livestock.

2. Analyze the methods used in caring for livestock that you own and the livestock on your home farm or ranch. Which parts of the work are being well done at present? What methods might be added or improved? Develop plans for satisfactory improvement.

3. Apply the proper methods of driving and handling each kind of livestock that you own or raise on your home farm or ranch. Construct the necessary equipment or devices for making this work easier—for example, a hand hurdle for driving hogs, a pig slapper for use in loading hogs, or a rope halter for a cow or calf.

4. Develop a suitable system of identification for individual animals of each kind of livestock you own or for one or more of the livestock enterprises on your home farm or ranch. Learn how to make ear notches or insert eartags, and then put the system into practice for each kind of livestock as planned.

5. With the assistance of your teacher and father, or others, learn to perform some of the following operations or skills in caring for livestock.

As opportunity arises, perform these skills on the livestock you own or on the livestock enterprises on your home farm or ranch

a Castrate pigs
b Put rings in noses of pigs
c Dock and castrate lambs
d Shear sheep, and tie fleeces
e Dehorn cattle by saw or clipper method
f Dehorn calves with caustic
g Castrate calves
h Brand calves with branding iron
i Place ring in nose of bull
j Throw a bull, and trim feet
k Teach a calf to lead
l Teach a colt to lead
m Break a colt to work
n Fit and adjust a harness
o Check the fit of a collar
p Clean repair, and oil harness
q Trim feet of pigs cattle, sheep and horses
r Fit and train pigs, cattle, sheep, or horses for show or sale
s Assist sows, cows, ewes, or mares at time of giving birth to young as necessary, and care for the newborn young in accordance with approved methods

6 Plan and put into operation a system of fast milking for the cows you own or for the cows in the home herd

6. Keeping Livestock Healthy and Sound

LOSSES by death and damage resulting from diseases and parasites are likely to be serious unless special attention is given to keeping livestock healthy and sound. While some losses are bound to occur at times in any herd or flock, the losses from diseases and parasites are often much greater than they should be. The following activities that help to reduce livestock losses are discussed in this chapter:

1. Planning a Health Program for Livestock
2. Maintaining the Health of Hogs
3. Maintaining the Health of Dairy Cattle
4. Maintaining the Health of Beef Cattle
5. Maintaining the Health of Sheep
6. Maintaining the Health of Horses and Mules

1. Planning a Health Program for Livestock

By developing health programs for livestock and thereby reducing damage from animal diseases and parasites, three distinct benefits are secured, (1) a reduction in death losses, (2) a reduction in losses from unthriftiness, and (3) protection of human health.

Reducing Death Losses. When an animal dies as the result of disease, parasites, or injury, it is, of course, a total loss. If the animal is also valuable as a breeder, the amount of the loss is increased. The extent of loss by death among animals, for the country as a whole, is difficult to determine with a high degree of accuracy because livestock raisers make no reports of such losses to any central agency where data might be assembled and summarized. However, as shown in Fig. 176, about 4 out of every 10 pigs born never reach market, owing to premature death losses. It is also estimated that 20 per cent of all dairy calves die before reaching productive age and that as many as 3 colts have to be born to raise 2 work horses. The financial loss to the livestock industry as a whole, due to the death of animals, totals many millions of dollars annually.

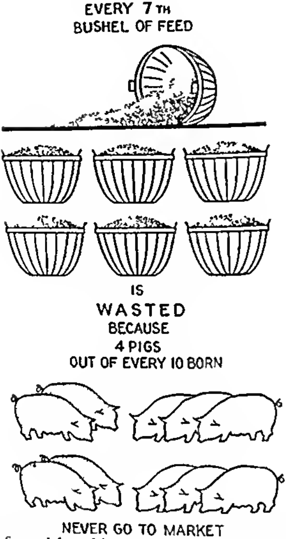

Fig 176 The financial loss of livestock producers caused by death of animals is tremendous This fact is illustrated in the above chart, showing that every seventh bushel of feed is wasted because of the loss of four pigs out of every ten born These deaths are the results of injury disease parasites poor feeding and other causes many of which could be prevented (*The National Livestock Conservation Program*)

Reducing Unthriftiness The second important source of financial loss to livestock raisers comes from diseases, parasites, and injuries that do not take the life of the animals affected but cause them to do poorly for short or long periods of time The annual financial loss from this cause alone is known to equal and probably exceed the loss by death Thus, many more millions of dollars are added annually to the total

livestock loss from disease, parasites, and injuries. Much of this can be checked by giving proper attention to the health of farm animals. In other words, many animals that pass through a period of sickness or an infestation of parasites or becoming injured could be saved from such a setback if proper precautions and preventive measures were taken.

Protecting the Health of Human Beings. A third serious menace from animal diseases is that some animal diseases are, in one way or another, transmissible to man. This fact was recognized early in the efforts of veterinary scientists to combat animal diseases, and the drastic measures adopted to cope with this menace were justified. Much of the work performed by the Federal and state governments in order to control and eliminate animal diseases has been directed toward the group of animal diseases transmissible to man. This is as it should be. Certain other diseases, equally important from the standpoint of financial loss to livestock raisers, have had to await their turn to be brought under control.

Tuberculosis is the outstanding example of an animal disease that can be transmitted to man. It has now been practically eliminated from cattle in the United States, through the long program of testing cattle and the slaughter of infected animals throughout the country. Similar efforts are already under way for the elimination of certain other diseases. Organized planning for the elimination of an animal disease from the entire country may become the pattern followed as time goes on. When you stop to consider the immense financial loss plus the threat to human health that exists in the presence of some animal diseases, it can readily be seen that the maintenance of animal health is one of the most important features of successful and profitable livestock raising.

Maintaining Animal Health in a Herd or Flock. The treatment of injuries and sickness in livestock and the prevention and elimination of diseases and parasites, viewed from the standpoint of national welfare, is the responsibility of the veterinary profession. Livestock owners must look to the veterinarian for information, direction, and assistance in their attempt to keep loss from injuries, parasites, and diseases to a minimum. With many of the problems of health, the only safe procedure for the owner is to call the veterinarian for diagnosis of the trouble, assistance in treatment of sick animals, and recommendations regarding preventive measures. Handling the health problem

in raising livestock, however, is so extensive and continuous a task that it cannot be left entirely to the veterinarian. Owners must support and supplement the work of the veterinarian in every way possible in order to make his work effective.

If a herd or a group of animals is to be kept in good health, the first principle involved is the old adage, "An ounce of prevention is worth a pound of cure." The livestock raiser's opportunity to avoid losses from diseases, parasites, and injuries lies almost entirely in his ability to prevent their occurrence in the first place. Once they have occurred, curative measures usually require the service of the veterinarian

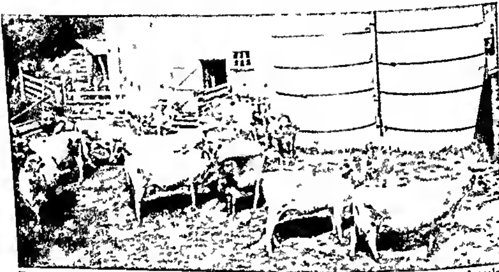

FIG 177. A healthy herd, such as this one, is the result of attention to many details, including sanitary surroundings, careful observation, testing of animals for tuberculosis and Bang's disease, and proper feeding and housing (*Michigan State College*)

Necessary preventive measures may be grouped under five headings: (1) maintaining proper sanitation, (2) vaccinating animals to produce immunity to certain diseases, (3) preventing injuries, (4) preventing losses from poisonous materials, and (5) observing animals closely. All these protective measures must be carried out while the animals are in good health and before any symptoms of impending trouble appear. The livestock raiser is usually a busy person. To the inexperienced or uninformed, treating a group of animals that appear perfectly healthy for the prevention of a possible parasite infestation or vaccinating a group of animals to prevent a possible outbreak of an infectious disease may appear to be an unnecessary expense and waste

of time. For that reason proper preventive measures are often overlooked. Such neglect often results in disaster later on.

Maintaining Proper Sanitation. All disease germs and parasites thrive best in filthy surroundings. Primarily, maintaining proper sanitation to combat them means maintaining clean surroundings for animals. To maintain clean premises for farm animals is in itself a large order. It requires, first of all, buildings so constructed that they can be kept clean. Proper ventilation, proper window space, floors that

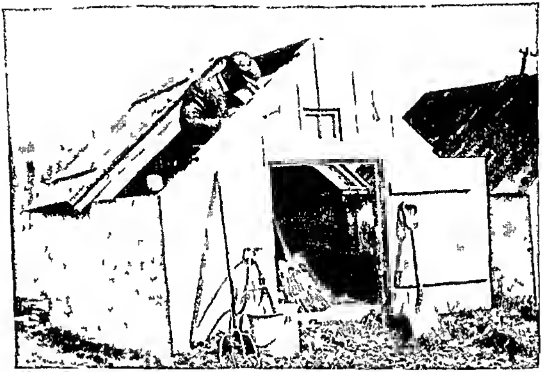

FIG 178 Proper sanitation is an important measure in maintaining the health of farm animals Hog houses to be occupied by brood sows and their litters should be thoroughly cleaned and disinfected Boiling water and lye are effective in the finishing stages of this cleanup (*U S Department of Agriculture*)

can be kept clean, and in many cases, as with hogs and dairy cattle, concrete floors that can be washed are all a part of good sanitation. The liberal use of disinfectants to kill germs and parasites on floors and walls and the washing or dipping of animals themselves, when necessary, with disinfectant solutions are also a part of sanitation. The treatment of animals internally with preparations to prevent or rid them of internal parasites should be considered simply a part of good sanitation and should be done before the animals become badly infested, rather than afterward. Avoiding filthy, muddy, poorly drained barnyards is a feature of good management in the care of animals.

The use of sufficient bedding to absorb liquid manure and thus avoid excessive soiling of animals while inside the barn is an important item

The dipping or treating of animals with proper solutions to prevent or rid them of external parasites such as lice, ticks, and mange comes under proper sanitation One means of protecting health in young animals, such as growing pigs and sheep, is to place them on fresh ground or fresh pasture that was not occupied by animals of the same kind the previous year

Vaccinating to Produce Immunity The discovery in 1881 by Louis Pasteur of a method to prevent sheep from developing anthrax marked the beginning of a new era in the treatment of many infectious diseases Later, Pasteur also developed a vaccine that successfully prevented the development of rabies, or hydrophobia, in dogs Previously defying treatment, many bacterial and virus diseases have since been brought under control by injecting a small amount of a preventive serum or bacterin into the tissues or blood stream of the animal A few of the serious animal diseases that may now be prevented from developing in animals by vaccinating them are cholera in swine, anthrax and blackleg in cattle, and sleeping sickness in horses Preventive vaccination is also practiced with at least partial success for some other diseases, notably brucellosis and hemorrhagic septicemia in cattle The wise rule for the livestock raiser to follow concerning vaccination of animals for the prevention of disease in case he is located in an area in which one or more infectious diseases are known to exist is to consult his veterinarian All vaccinations should be administered by a skilled veterinarian

Preventing Injuries Many injuries to animals occur each year Some result from unavoidable accidents, but many come from careless or thoughtless handling and are preventable Keep barns, yards, and pastures free from loose boards with nails in them, pieces of barbed wire, and all other sharp projections on objects that might injure animals in any way Do not allow farm machinery to stand in the barn yard or pasture for animals to trample over or run into, this is an all too common cause of injuries Hurried or rough handling of animals in driving or attempting to catch them and striking or prodding while loading them into trucks or railway cars are other causes of costly injuries

Preventing Losses from Poisonous Materials All animals are subject to the effects of poisonous materials Poisons that may cause sick

ness and death in animals may be taken into the digestive system from many different sources. The several common sources may be classified into three principal groups: (1) poisonous plants, (2) poisonous materials that may develop in feeds through spoilage due to molding or rotting in storage, and (3) chemical poisons accidentally consumed.

1. *Poisonous plants.* Poisonous plants consumed by animals while grazing are a frequent form of poisoning. Symptoms of violent poisoning from plants are somewhat the same. While not always present, some common symptoms are: frothing at the mouth, a staggering gait, falling, difficult breathing, a stupor or coma condition, then death. An animal may show some or all of the above symptoms in rapid succession and die within an hour after consuming the plant, or the poison may progress more slowly through a period of several hours. The only treatment to try to save an animal from a case of violent plant poisoning is to administer a strong laxative such as an Epsom salts or linseed-oil drench. For cattle 1 lb. of Epsom salts or 1 qt. of linseed oil would be the proper dose, and for a mature sheep one-fourth pound of Epsom salts or one-half pint of linseed oil.

Many animals may eat just enough poisonous-plant material to make them violently sick but still recover. Continual eating of mildly poisonous plant material may cause a cumulative toxic effect and result in unthriftiness in the animal without causing death. Among the most common poisonous plants are the common or bracken fern, the common crowfoot, the Indian turnip, henbane and jimson weed, water hemlock, white snakeroot, death camas, laurel, larkspurs, locoweed, and rayless goldenrod.

Fortunately nearly all of the poisonous plants are unpalatable to animals and are eaten only when the supply of grazing is limited and the animals become very hungry. On the range certain poisonous plants show up as the first green feed in the spring. Since many poisonous plants grow in small patches in locations favorable to them, an attempt should be made to detect any infestation of such plants on a farm or ranch and either eradicate them or keep animals away when plants are in the poisonous stage.

A few valuable pasture and forage plants are known occasionally to cause poisoning of animals. Sorghum and Sudan grass have the most severe score against them. Under certain conditions not thoroughly understood, these plants cause *hydrocyanic acid poisoning*, which may be sufficiently violent to cause death of animals. Poison-

ing by these plants seems to be completely prevented by avoiding pasturing when the growth is short, soft, and very high in water content, such as early in the spring or a fresh growth following the breaking of a dry spell by a heavy rain

2 *Spoiled feeds* Animals are occasionally poisoned by giving them feeds that have spoiled in storage Moldy hay, moldy silage, or moldy grain may produce bad effects Such feeds should not be fed at all or fed along with other sound feed If fed, one or two animals of low value should be given some of the spoiled feed for 2 or 3 days before risking it on a large group

Ergot a fungus which sometimes develops in the kernel of grain while it is growing in the field, may be poisonous if contained in grain in amounts above 5 per cent of the kernels The ergot kernels are easily recognized by their dark brown to black color, enlarged size, and slightly different shape from the normal kernel Grain heavily infested with ergot should not be used as feed Rye is more likely to contain a higher percentage of ergot than wheat, oats, or barley Usually animals do not die from ergot poisoning unless heavy feeding of heavily ergot infested grain is continued over a period of time totaling at least 2 or 3 weeks

3 *Poisoning from chemicals* Occasionally one or more animals may be accidentally poisoned by eating some violently poisonous substance Licking of fresh paint containing white lead from a freshly painted barn or shed is one of the most frequent causes of such poisoning Care should always be exercised in using any poisonous drug in the treatment of animal injuries to avoid leaving the container where an animal may accidentally get at it

Occasionally seed grain that has been treated with a poisonous chemical is accidentally eaten or intentionally given to animals with the hope that it will not poison them Never give leftover seed grain treated with poisonous chemicals to animals regardless of how long it may have been allowed to stand before being fed

Observing Animals Closely After all possible precautions have been taken through proper sanitation vaccination and prevention of injuries, there is a constant hazard from new or unforeseen health problems arising in a group of animals without warning The livestock raiser must therefore be ever on the alert for the first symptoms of any form of ill health Watch for such manifestations as failure to graze or eat normally an inclination to lag or drop behind the other animals

and lie down, or the desire to remain in sleeping quarters during periods when other animals in the group are normally out of doors—they may be taken as indications that something is wrong. Animals so affected should be observed several times each day. If several show the same symptoms and you are unable to diagnose the trouble, the only safe procedure is to call the veterinarian without further delay.

2. Maintaining the Health of Hogs

Hogs, especially small pigs, are susceptible to many diseases and parasites. Several of the diseases are not as yet well understood, and the death loss from them is high. Many hog diseases and parasites

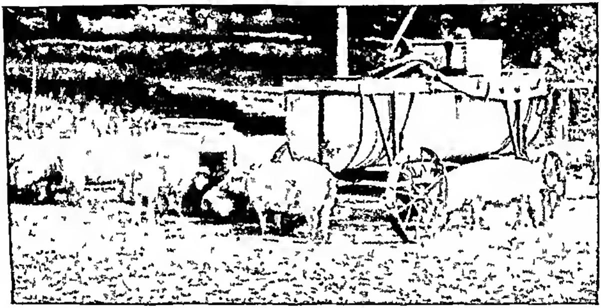

FIG 179 Sanitary surroundings are essential in successful hog production This tank wagon is used by an Iowa farmer for hauling water to his hogs on clean pasture Water from the tank wagon goes into the self-waterer shown (*A M Wettach, Iowa.*)

are filth-borne. The idea that a hog likes filth and can survive in filthy surroundings is all too widespread. In reality, if given a chance, the hog is a cleanly rather than a filth-loving animal. The starting point in the reduction of loss from diseases and parasites in hogs is a better understanding on the part of hog owners and caretakers of proper sanitation and providing it in the day-to-day care of hogs.

Effective sanitation in the care of hogs has three general requirements. (1) When large permanent buildings are used, they must have concrete, tile, or tightly built wood floors that are well drained so that they may be thoroughly cleaned, scrubbed, and disinfected. Such buildings must also be provided with ample window space well

located so that the interior of the building may be flooded with sun light (2) If any outdoor space adjacent to such a permanent hog house is used for yarding or exercising hogs, it should be paved with concrete so that it may be cleaned and disinfected (3) If hogs are moved from the permanent house to be raised on pasture, they must be moved to a fresh pasture that was not grazed by hogs the previous year Likewise, if small field houses are used for farrowing, these must be thoroughly cleaned and moved to a fresh pasture not occupied by hogs the previous year

Diseases and parasites most commonly encountered in raising hogs are discussed below

Hairless Pigs. The condition commonly known as "hairlessness" is the one that appears earliest in the life of the young pig For years it was thought to be due to incorrect feeding of brood sows and lack of sufficient exercise Its prevalence has declined since the cause and method of prevention were discovered Pigs born with little or no hair on them show general lack of vitality and lack of desire to nurse their mother Most pigs born in this condition die during the first day or two of their lives

This condition is caused by lack of sufficient iodine in the ration fed to the sow It is common in areas of the country known to be deficient in iodine The hairless condition of the young pigs is often accompanied by a goiter condition, indicated by enlargements in the neck region To prevent the disease, feed brood sows potassium iodide throughout the period of pregnancy The most common way of feeding the potassium iodide is to include it in a mineral that is self fed or fed at the rate of 1 lb of the mineral mixture with each 100 lb of feed Only a very small amount of potassium iodide is necessary One ounce of potassium iodide crystals thoroughly pulverized and mixed with 100 lb of mineral mixture is enough Providing iodized salt in a box or self feeder is also an effective method of supplying iodine

Baby pig Ailments Many losses of pigs may occur during the 3 or 4 days after farrowing Because not all of the causes of these losses are known the names "baby pig disease" or "three day disease" have been used for some of them Two ailments that contribute to the losses in some cases are *hypoglycemia* and *transmissible gastroenteritis*

Hypoglycemia is an ailment of pigs that may develop 2 or 3 days after farrowing In this ailment, there is a drop in the blood sugar, and

starvation may follow, which may be due to a failure of the pig to get enough milk. Chilling may bring on the ailment more quickly, as the supply of carbohydrates in the pig's body is used up rapidly in providing body heat. If a pig brooder is provided to prevent chilling, losses are less likely to occur.

Pigs with this ailment have a rough hair coat, shiver, and fail to nurse. If treated early, some of the ailing pigs may be saved. Give each pig 1 or 2 teaspoons of a warm solution of equal parts of corn syrup and water. Repeat this every 2 or 3 hr. When appetite returns, provide some cow's milk, or use some modified cow's milk made by adding the white of one egg, 3 oz. of cream, and 3 oz. of limewater to 2 qt. of milk. After one or more feedings, return the pigs to the sow. If the sow is not giving enough milk, stimulate production by improved feeding.

Transmissible gastroenteritis occurs in pigs of all ages, but the death rate in young pigs may be high. This disease is caused by a virus which is easily transmitted from pig to pig. Treatment of ailing pigs is not often successful. If the disease occurs where several litters are close together, the ailment may spread rapidly. It may be checked if the sows that have not farrowed are moved onto clean fields away from the ailing litters.

Other losses of baby pigs may occur from crushing by the sows, especially during the first 2 or 3 days after farrowing. These losses may be reduced by using sloping floors, pig brooders, and guard rails, and by using only small amounts of bedding. Some of these losses from crushing may be due in part to weaknesses of pigs caused by faulty nutrition or other ailments.

Pig Anemia. Pig anemia has been found to be a nutritional disease of young pigs. It appears between the age of five days and five weeks and is due to a lack of sufficient iron in the feeds. Symptoms are that a litter of pigs appears to be normal and doing well up to five days old or even up to four weeks old. Then, one after another the pigs become sick and die within a day or two.

Pig anemia usually appears only in early-farrowed spring pigs in the northern areas or in pigs that are kept entirely on a hard floor until several weeks old. It has been found that where pigs are on the ground by the time they are three to five days old they get enough iron from the soil, even though it is an extremely small amount, to prevent the deficiency of iron in the blood. Where young pigs must be kept in-

doors until they are several weeks old, all that seems to be necessary to prevent the occurrence of anemia is to place a little clean earth in the farrowing pen or in the alleyway where the pigs exercise so that they can nose around in it and get a little of it into their mouths This simple precaution seems to be enough to prevent this trouble. Provide a large box or barrel of fresh, clean earth in the hog house each fall before the ground freezes so that it will be available when needed in the spring Pieces of sod may be used instead of the loose soil

Influenza and Pneumonia. Swine influenza was first diagnosed as a virus disease in 1918 It is usually accompanied by a bacterium, which has also been isolated It has been prevalent in all parts of the United States during the last 25 years Influenza is most likely to occur in pigs weighing from 100 to 200 lb and generally appears during the early fall months when the first cold rains occur, however, it may affect pigs of any age and may appear at any season of the year

The symptoms of influenza are that suddenly a large number of pigs in a group become sick They lie in their usual sleeping place and do not care to eat They show difficulty in breathing, by a thumping or pumping movement of the rear flank If forced out of their sleeping quarters, they have a violent coughing spell They run a temperature up to 104 to 106°

Usually, the pigs begin to recover from influenza in 4 to 5 days and in 10 days will be back to normal An occasional case of influenza develops into pneumonia, and a few pigs may die Losses from the disease are principally a decrease in weight during the sick period and failure of some pigs to return to normal, such pigs remain unthrifty and are unprofitable

There is no certain method of prevention and no cure that will hasten recovery Provide dry, well ventilated sleeping quarters as free from dust as possible, and protect from drafts These measures are recommended as preventive and as treatment for pigs that are sick with influenza It is thought to be helpful to withhold feed entirely from pigs sick with influenza until they show that they are hungry again

As previously indicated, pneumonia sometimes follows influenza It may develop as a complication along with several other hog diseases or as an infection of the lungs without the presence of any other symptoms Little can be done by way of treatment for a hog affected with pneumonia Pigs with mild cases may recover, but severe cases usually result in death

Necro or Sore Mouth. This disease appears in the form of sores on the lips and tongue or sometimes on the lower part of the legs of young pigs The sores are caused by a bacterial infection They are deep-seated and covered by a heavy cheeselike scab If infected pigs are allowed to remain in a group, the infection will spread Infected pigs become unthrifty, and some die Even after treatment those which recover usually remain unthrifty and prove unprofitable

If the disease is detected in the early stages when only a few pigs are affected, it is considered advisable to destroy the infected pigs to prevent its further spread If treatment is undertaken, paint over each sore with tincture of iodine or dip the infected parts in a moderately strong disinfectant solution Repeat treatment daily until all the sores that can be found are healed

Intestinal Enteritis. This disease is thought by some to be a continuation of the necrotic infection just described into the digestive system It may be caused by germs other than those causing the sore mouth condition, for many pigs show typical intestinal enteritis without having this condition Intestinal enteritis is a highly virulent infection and may spread through a large herd of hogs in a few days' time Symptoms are a bloody mucous diarrhea, a high fever, and loss of appetite If a strong intestinal antiseptic can be introduced in the digestive system of the pig during the early stages of the disease, recovery may be speedy The sulfa drugs are being used with marked success *As soon as an infection of intestinal enteritis is suspected,* call the veterinarian, for treatment with a sulfa drug should be prescribed by him

The important procedure in the control of an intestinal enteritis infection on a hog farm is to move healthy pigs to a clean location and abandon the infected premises for at least 6 months The infection does not seem to live very long outside the body of the hog

Brucellosis, or Infectious Abortion Contagious abortion of cattle is frequently referred to as "Bang's disease" In hogs and cattle, it is coming to be called by its more scientific name, "brucellosis" This term is taken from the word "Brucella," the name of the germs that cause the disease

Although some sows with brucellosis abort partially developed pigs, not all sows that carry the germ abort Boars and open gilts or sows may also carry the germ In some cases, this disease may be in the herd without the owner being aware of it The only way to determine for

sure if it is present or not present is to test a sample of blood from each hog in the breeding herd A veterinarian is needed to collect the blood samples and to arrange for testing them

The aim of every hog raiser should be to develop and maintain a brucellosis free herd If all blood tests show negative, the herd is probably free from the disease Annual tests should be made of breeding stock to assure the maintenance of a clean herd If reactors are found, they should be sold and the remainder retested in 30 to 60 days After two negative tests in a row, the herd can usually be assumed to be free from this disease Annual tests should be made thereafter

Purchase hogs from brucellosis free herds, and run a check test on the animals purchased Even if the tests show negative, it is safest to isolate newly purchased animals for about 60 days and then retest them

People in contact with hogs having brucellosis may contract undulant fever

Erysipelas During recent years, this disease has been diagnosed in swine in a number of widely separated areas in the United States There are many areas where it has not yet made its appearance or at least where it has not yet been identified It is caused by a germ and is mildly contagious It is difficult to recognize because it appears in several different forms with different symptoms It may appear as an acute blood poisoning, as a skin rash, as a stiffening of the joints, or as sores on the skin Early symptoms can easily be confused with the symptoms of cholera, intestinal enteritis, or influenza A new infection of this disease often gets a good start in a herd before it is recognized because the first symptoms are so easily confused with those of influenza, especially in an area where influenza is common and erysipelas little known Unless a veterinarian experienced in observing the symptoms of erysipelas happens to be called to look over a group of sick hogs, erysipelas is not likely to be suspected until the hogs fail to recover as they should from suspected influenza or enteritis and the later symptoms begin to show

The symptoms of the first, or acute, stage of erysipelas are a tendency for the animal to arch its back appear tucked up in the rear flank, and walk with a stiff gait, giving the impression that walking is painful This stage is accompanied by a high fever In the second, or intermediate, stage the hog becomes very weak and, if it can walk at all, walks with a stiff, staggering gait The skin along the abdomen may

be purplish red in color, and that about the ears and over the back may become thick and scablike The joints of the legs may show swellings The temperature may be very high Many pigs affected with erysipelas die during the first or second stage of the disease A good many live through the disease and begin to show recovery, but this is slow In many instances, the disease assumes a chronic form, or third stage, in which the hogs are weakened and spend most of the time lying down or sitting on their haunches They usually breathe with difficulty Large abscesses may appear along the back or on the ears Once this stage of the disease has been reached, destroy the animal, for it will never recover to the extent of becoming a profitable hog and will spread the disease

These symptoms of erysipelas are stated so that the observing hog raiser may suspect its presence and call a veterinarian for diagnosis The presence of erysipelas can be diagnosed accurately only by a post-mortem examination of one or more infected animals and finally the making of laboratory tests to identify the specific germ that causes it

When erysipelas is diagnosed in a herd of hogs, the recommended procedure is to move to clean ground and premises those appearing to be well and not yet infected Have a veterinarian vaccinate those which are sick with a curative dose of antierysipelas serum and those in good health with a smaller dose of preventive serum The antiserum properly administered has proved highly effective as a cure if administered during the first stage of the disease It is also effective as a preventive in animals not yet showing symptoms in infected herds Leave those animals which have been sick with erysipelas in the infested surroundings until such time as they have been cured and marketed or destroyed Allow the infected premises to remain idle for at least 6 months after the last hogs have been disposed of before again putting hogs in those surroundings Follow this plan whether the hogs are treated with antiserum or not

The McLean County system of swine sanitation is a good preventive measure Also, in purchasing hogs, be certain that they come from farms free of the infection Isolate newly purchased hogs for 60 days

Hog Cholera. Before the introduction of the serum-and-virus treatment of pigs for the prevention of cholera, about 1910, this was the disease most dreaded by all hog raisers Symptoms of cholera are diarrhea, high fever, and a pink to purple coloring of the skin along the underline Affected pigs quit eating, and nearly all affected animals die in 3 to 10 days

In infected areas, hog raisers no longer take any chance with this disease Instead, they have all pigs vaccinated when six to ten weeks old as a preventive measure Vaccination with the serum-and virus treatment produces immunity for life It is preferable to have vaccinating done by a veterinarian

Several new vaccines have been developed for use in preventing hog cholera *Crystal Violet Vaccine* and *Boynton's Tissue Vaccine* (*B T V*) are two of these products *Modified Live Virus* (*M L V*) is a new material with considerable promise None of these vaccines will contaminate the surroundings, and hence there is no danger of spreading cholera, as may be the case with full strength virus There is less possibility of 'breaks,' which have sometimes recurred after vaccination with the serum and virus method One of the disadvantages of the new vaccines is that it is not known for sure if they give permanent immunity beyond the normal marketing age, and therefore revaccination may be advisable Consult your veterinarian regarding the use of these vaccines

Infectious Rhinitis This disease has recently become serious in many swine herds in the Middle West and in some other parts of the United States The most common symptoms are sneezing of baby pigs, distorted noses in growing pigs, and frequent nosebleeds in older pigs The pigs become unthrifty and many are stunted

The disease is infectious, that is, it is caused by germs, but the methods by which it spreads from one pig to another are not fully understood It is believed that the disease is usually brought into a healthy herd through the purchase of a carrier hog which shows no symptoms of the ailment Hence, the best preventive measure in a healthy herd is to use great care in purchasing hogs to make sure they come from herds known to be free of the ailment

There is no known treatment for infected animals One recommended method of control is to sell all hogs, whether infected or not, in a herd in which the disease has appeared Follow this by thoroughly disinfecting all equipment with a steam cleaner or a strong chemical disinfectant Secure a fresh start with breeding stock from herds known to be free of the disease, and raise hogs in a new location, apart from the old lots

In some herds in which the disease has appeared, there are sows which are especially valuable It may be advisable to keep these sows for further litters However, each sow should farrow in separat quarters, and each sow and litter should be *kept separated* If th

disease appears in a litter, move the sow and pigs to a place completely isolated from the others. Save pigs for breeding stock only from litters in which the disease has not appeared.

Nutritional Diseases of Hogs—Rickets. Because hogs are normally fed largely on farm-grown grains and often do not have access to green pasture growth or the soil, the caretaker may unknowingly be feeding a ration deficient in one or more elements essential to health and normal growth. The rapid-growing characteristic of pigs creates a need for a liberal supply of protein and certain mineral elements in the ration. A hog may easily suffer from insufficient feed of any kind but is more likely to suffer from a shortage of protein than from any other nutritive compound. Mineral deficiencies are frequently encountered.

Hairlessness and goiter in pigs at birth as a result of iodine deficiency have already been discussed. It was pointed out that pig anemia results from a deficiency of iron. A condition known as *rickets,* which is paralysis of the muscles and abnormal development of the bones in the legs, accompanied by pain, lameness, and serious lack of thrift, is caused by insufficient phosphorus or calcium, or both. Too little vitamin D is a contributing factor in rickets. Lack of sufficient vitamin A results in slow growth.

The so-called "nutrition" or "deficiency diseases" are, in reality, conditions resulting from malnutrition. For their prevention and cure refer to the discussion of correct feeding in Chap. 3.

Internal Parasites. There are many internal parasites that infest hogs. Most serious of all is the *roundworm.* Fortunately, the life history of this parasite is known. This makes its control simple except for the work required in taking the precautions necessary to prevent it. The life history is shown in Fig. 180.

Important procedures in preventing the infestation of pigs with the roundworm are the practices of effective sanitation in buildings and the placing of pigs on fresh, noninfested pastures each year.

Worms can be killed and eliminated from the digestive tract of pigs by the use of medicines. One of the most effective materials for this purpose is sodium fluoride. Mix thoroughly sodium fluoride at the rate of 1 per cent in enough of the ration in dry, ground form for 1 day's feeding for the entire herd. If the pigs are not accustomed to ground feed, put them on the feed in dry, ground form for several days without the sodium fluoride added. Slightly underfeed the pigs on the day prior to the day of the treatment. Then, for 1 day only, feed the pigs on

the dry mixture to which sodium fluoride has been added Treat pigs at 2½ months of age and again at 4 months Do not treat pregnant or milking sows

The objection to leaving pigs on infected premises even though they have been dosed for worms is that they immediately pick up new eggs and become reinfested Careless hog raisers still raise hogs year after year in the same buildings and on the same premises Under such circumstances, many pigs do survive the effects of the worms but become

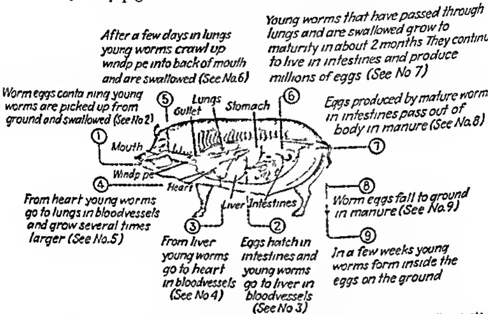

FIG 180 The intestinal roundworm is a serious parasite of hogs It starts journey through the pig when eggs containing roundworms are picked up fro the ground and swallowed The various stages of the life history are described a numbered in sequence (*Bureau of Animal Industry, U.S Department of Agric ture*)

so unthrifty and stunted that they are not profitable Such hog raise usually give up hog raising as an unprofitable enterprise

A swine sanitation plan has been developed that effectively preve roundworms and certain filth borne diseases This method is commo called the "McLean County system of swine sanitation" because it w perfected in that county in Illinois under the direction of the Bureau Animal Industry of the U S Department of Agriculture. The syst consists of the following four essential steps

1. Clean the farrowing pens thoroughly with boiling water and prior to farrowing, or use a steam cleaner This destroys the rou worm eggs and disease organisms

FIG. 181. Steam generator outfits are highly effective for sterilizing hog houses and equipment. (*Top, Robert Howey, Illinois; bottom, Gene Cooper, courtesy of* Country Gentleman.)

2. Wash sows with soap and warm water before placing them in the farrowing pens. Give particular attention to cleaning legs and udders. This removes roundworm eggs and disease organisms that may be present in foreign matter on these parts of the sow.
3. In about 2 weeks after farrowing, haul sows and litters to clean houses on clean-ground pasture. This prevents contamination from old lots.
4. Keep pigs on clean pasture until they are at least four months old. Damage is not likely to be so serious if they get roundworms after this age.

One successful modification of this plan is to have the sows farrow in movable houses on clean-ground pasture after the first two steps have been followed. The sow and her litter are kept on this pasture after farrowing takes place.

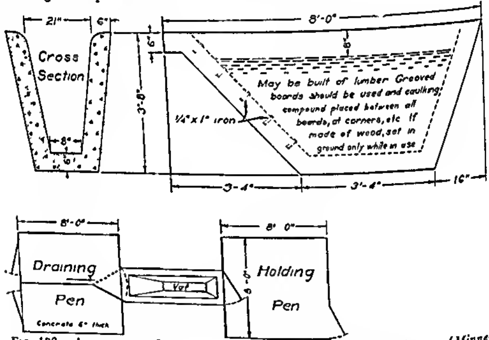

Fig 182. A concrete tank and layout suitable for dipping hogs or sheep. (*Minnesota Experiment Station*)

Mange. At least two varieties of mange mites infest hogs. They burrow into the skin about the roots of the hair, which results in small red patches resembling large pimples and causing severe irritation. Mange-infested hogs are almost continually trying to scratch the affected parts by rubbing on anything they can reach. The infestation usually starts on the skin of the rear flank and between the rear legs and spreads

forward along the belly, between the forelegs, and then upward on the ham and sides If allowed to go untreated, the skin becomes thickened and covered with a deep layer of dry, scabby material This must be trimmed from affected parts when the hogs are slaughtered Besides causing unthriftiness in the hogs, the trimming of carcasses after slaughter is an additional loss Hogs heavily infested with mange are discounted in price at the markets

Common mange may be controlled in its early stages by applying used crankcase oil at 10 day intervals for two or three treatments However, one of the most effective materials is *benzene hexachloride* (BHC) Spray the hogs with BHC wettable powder mixed with water in accordance with the instructions of the manufacturer. Be sure to get some of the materials on the undersides and between the legs of the hogs Benzene hexachloride in dust form may be used in winter *Lindane* and *chlordane* are two other chemicals effective for mange, but they are usually more expensive than BHC

A form of mange known as "demodetic mange" is not easily controlled Infected animals should be sold as soon as identified

Lice. Hog lice are of several kinds All are large enough so that they are readily distinguishable on close inspection One method of controlling lice is to apply used crankcase oil Crowd the pigs together and thoroughly cover them They must be treated again in about 14 days to kill the lice hatched since the first treatment

A single treatment by spraying with BHC, lindane, or *chlordane will* control lice on swine Toxaphene is also effective Follow instructions of the manufacturer in using these materials

Sunscald. Sunscald is a chapping or sunburning of the skin It usually develops when young pigs that have been in the shade are turned into a summer pasture containing a tall growth of any grazing crop The hot sunshine causes the burn, and the pasture plant irritates the tender burned skin as the pigs travel through it White pigs are most susceptible to sunscald, or chapping of the skin

If pigs show a heavy sunburn about the ears, shoulders, and neck, confine them immediately to a shaded space until the burn has healed Spraying them with a mild stock dip solution once each day will help to heal the skins if the pigs are kept in the shade A still better treatment is to smear over the affected parts a medicated or carbolated vaseline Start treatment as soon as the sunburned condition is noted, for if pigs are allowed to remain out in the hot sun the skin over almost the entire

body surface may become irritated Pigs can and do die from the effects of sunburn Accustom young pigs to strong sunshine gradually if they must be turned from quarters where they have been in the shade all the time to an open field in hot weather

3. Maintaining the Health of Dairy Cattle

Dairy cattle are susceptible to all the diseases and parasites that affect beef cattle The treatment and control measures are, of course, the same Several ailments common to all cattle are discussed in the next section of this chapter However, because dairy cattle are housed much of the time and handled in compact groups, the spread of some of the diseases, notably tuberculosis and Bang's disease, is likely to be more rapid and to reach a higher percentage of animals in the herd More over, the progress made by dairymen in breeding cows capable of producing 50 to 100 lb of milk daily, containing 2 to 3 lb of butterfat, has brought with it new problems a new type of trouble commonly referred to as "nutritional diseases" is now frequently encountered in dairy cattle The fact that dairy calves are raised by feeding them skim milk and, in some cases, largely without even skim milk introduces the nutritional disease problem as well as some other diseases not commonly encountered in the raising of beef calves

Brucellosis or Bang's Disease. Brucellosis or Bang's disease (formerly called "contagious abortion") is one of the most damaging diseases of cattle It is not fatal, and it usually does not cause serious unthriftiness in affected animals One of the losses from this disease is the premature birth, or abortion, of the calf However, not all cows affected with brucellosis abort their calves Infected cows that abort usually fail to milk normally, and there may be serious losses from this source as well as from the loss of calves Furthermore, breeding difficulties owing to sterility may occur with many cows which have the disease Thus, it can be seen that brucellosis may cause serious losses in a herd and interfere greatly with plans for herd improvement

The disease is caused by a form of bacteria called *Brucella abortus* Animals are usually infected through eating feed contaminated by these microbes or in other ways which permit the bacteria to enter the digestive tract In addition to the above type of brucellosis which ordinarily affects cattle, there is one form which ordinarily affects hogs, and another form which may affect goats Man is susceptible to all three forms and from any of them may get a disease called "undulant fever"

In detecting and controlling brucellosis in cattle, the milk ring test, the blood test, and calfhood vaccination are valuable tools The milk ring test is a promising method for detecting the presence of brucellosis in a milking herd A sample of milk is taken from a mixture of all the milk produced in a herd on a given day, and a special laboratory test is made of this sample If the test is negative, the producing cows in the herd are probably free from the disease If the ring test is positive, one or more cows in the producing herd are reactors If this happens, the blood test is necessary to detect the individual cows which are reactors This test is made with the help of a veterinarian who draws a blood sample from each cow and runs the tests on them or sends them to a laboratory (The blood test may also be used as a further check on all individuals over six months of age in a herd which is negative to the milk ring test)

In a herd in which reactors are found, calfhood vaccination of heifers may be recommended by the veterinarian in conjunction with some plan for cleaning up the herd In this case, all heifers as they reach the age of six to eight months are vaccinated with a vaccine called "Strain 19 "

One of several plans may be used to control brucellosis in a herd Two plans commonly used are described in the following paragraphs In either plan, all animals over six months of age are blood tested regularly The assistance of a veterinarian is needed in any program of control

If only a few reactors are found in a herd, the plan usually followed is the so-called "test and slaughter" program The reactors are sold at once for slaughter Buildings are thoroughly cleaned and disinfected Animals in the herd are retested with the blood test at intervals of about 30 days until two negative tests have been made for the entire herd Another test is then made 6 months later and only at yearly intervals thereafter if the previous three tests are negative In this program, the calfhood vaccination of heifers may or may not be carried on

A second program for an infected herd is sometimes called the "test and deferred slaughter" plan This program may be followed in a herd with a large number of reactors The reactors that are good producers are retained until they can be replaced by heifers Tests are made regularly All heifer calves are vaccinated as they reach six to eight months of age In this program, it is preferable to place the reacting cows, that are not sold immediately, in a separate herd If kept in the

herd with the negative cows, strict sanitation must be followed. Cows at calving time should be isolated and special precautions taken at all times to avoid contaminating the feed of the healthy cows. Reactors are sold as fast as heifers are raised to take their places. As early as possible, all reactors should be sold and the first program adopted.

During a cleanup program, no cows should be brought into the herd from outside sources. Once a herd is cleaned up, only negative cows from negative herds should be purchased if it is advisable to add to the herd from outside sources.

FIG. 183 The use of the strip cup aids in checking on ropy and flaky milk, frequently one of the first stages of mastitis A laboratory test of a sample of milk from each cow is necessary for accurate diagnosis of mastitis (*Michigan State College.*)

Many states have special programs for the control of brucellosis in cattle, with indemnity provisions for paying part of the losses incurred by farmers in selling reactors for slaughter. Dairymen should look forward to developing brucellosis-free herds because of tightening restrictions on the sale of milk and the demand for breeding stock from negative herds.

Mastitis. Mastitis is the term commonly applied to almost any abnormal condition in the udder of the cow. It is a serious and costly disease of dairy cattle. There are two forms of the disease, acute and chronic. The chronic is most common, but it may be present in a herd without being recognized.

The acute form of mastitis is commonly known as "garget," and its symptoms usually are recognized easily. These are pain and swelling in one or more quarters of the udder and the production of thick, ropy, flaky, or bloody milk. The acute form usually represents a flare-up of the chronic form already in the udder. A cow which recovers from an acute attack usually continues to have the chronic form.

Two tests aid in detecting chronic mastitis. One of these is the proper use of the strip cup. Several streams of milk from each teat are forced onto a fine-mesh screen which covers the strip cup. The appearance of ropy or flaky material on the screen is an indication of mastitis. Use the strip-cup test on each cow at every milking and make it a part of the managed-milking method described in Chap. 5. The second test for mastitis is a chemical test made on a carefully taken sample of milk from each cow. Each of these samples is taken by milking directly from each teat of the cow into a small, sterilized bottle, after wiping the teats and udder with a cloth moistened with a mild chlorine solution. Before taking the sample, discard the first-drawn milk from each teat. Take the sample at any time except within 2 hr. after a regular milking period. The samples are turned over to a laboratory where a special chemical test is made on each to determine whether or not the cow's udder is infected with mastitis. If some of the cows in the herd are found to have the infection, repeat tests at intervals of about once a month for the entire milking herd.

Infected cows may be treated by injecting into the udder through the teats certain drugs, such as penicillin, sulfamethazine, or others. This treatment and other methods of control should be carried out under the direction of a veterinarian. Badly infected cows should be sold for slaughter or placed in a separate stable. Slightly infected cows, if kept in the herd with the healthy cows, should always be milked last. Before milking, wipe the udder of each cow with a clean cloth dipped in a chlorine solution. Use a separate cloth for each animal, and sterilize all cloths before they are used again. In using the milking machine, dip the teat cups in water and then in a chlorine solution before milking each cow. Use other features of the managed-milking system described in Chap. 5.

Several measures are helpful in preventing mastitis in a clean herd. Use proper milking procedures, provide ample bedding, and bring only healthy cows into the herd. At least twice a year, use the chemical test for samples of milk drawn from each cow, as indicated above, and thus

detect any possible infection before it spreads Treat promptly all injuries to teats and udders

Milk Fever Milk fever is a condition usually appearing only in high producing cows during the first few days after calving The common symptoms are that the cow does not eat and soon develops a staggering walk followed by inability to get up after she lies down A characteristic symptom is a desire on the part of the cow to lie with her head turned back along her side

One treatment for milk fever was discovered before the cause of the disease was known This treatment was to pump filtered air into the teats with a special pump and to put a tape or bandage around each teat to hold the air in for a time Why this treatment cured the trouble was not known until the cause of the disease was discovered The cause of milk fever is now known to be a lowering of the calcium salts of the blood by the rapid formation of milk in the udder

A recent method of treating milk fever consists of injecting into the blood vessels calcium chloride or calcium gluconate Such treatment has been found to bring about very rapid recovery by quickly supplying the animal with the needed calcium Presumably the effect of pumping air into the udder was to develop pressure which stopped the secretion of milk temporarily and gave the animal a chance to build up the depleted supply of calcium in the blood It is on this same assumption that milk fever is much less likely to occur if the heavy milking cow is not milked completely dry for the first several days following calving This will retard milk secretion and give the cow a chance to become adjusted gradually to the new demand for a large amount of calcium in the production of milk

Watch every high producing dairy cow closely for the first symptoms of milk fever for several days following calving During this period feed moderately and leave some of the milk in the udder Then if the first symptoms of milk fever do appear call the veterinarian at once Treatment must be administered promptly or the cow will die

Nutritional Deficiencies A high producing milk cow may suffer nutritional deficiencies simply because she is not receiving enough feed of any kind This often occurs when the dairy herd is turned onto a poor pasture and the cows are given no additional feed The cows simply cannot get enough grass to supply their needs The same situation occurs in winter when they are fed only hay What happens is that the cow's milk producing system works so effectively that, besides using what

nutrients she secures in her feed, she draws on her own body tissues for materials with which to manufacture milk. The result is that she becomes thin and then her milk production drops. A repetition of this experience through two or three lactation periods will so weaken the cow that she will probably fail to get in calf or, if she does, will become a poor rather than a high producer.

A cow may receive enough of all the nutrients she needs except protein. Thus, to avoid nutritional deficiency, make sure that sufficient protein is being supplied. There may then still be a deficiency in the ration of the mineral elements of calcium and phosphorus. To avoid the nutritional-deficiency diseases the caretaker must understand the nutritive requirements of milk cows and see to it that they are fed accordingly. For this information, see Chap. 3, in which the feeding of milk cows is discussed.

Sore Teats. Sore teats from any one of a number of causes are a common occurrence among dairy cows. Washing the teats before milking and care and cleanliness in milking will help to prevent this condition. Sometimes, the sore teats may be due to a severe injury or to an infection of cowpox. Whatever the cause, one method of treatment consists in bathing the teats with warm water, drying them, and treating them with carbolated or medicated vaseline after milking. Occasionally it is necessary that a milk tube be inserted into the sore teat at milking time to draw off the milk with the least discomfort. Extreme cleanliness must be observed in the use of the milk tube in order to avoid introducing infection of some sort into the udder.

Calf Scours. The condition known as "scours" in calves is familiar to every caretaker of dairy cattle. Scours are of two types. The one usually referred to as "common" scours is caused by feeding; the other is due to infections of bacteria in the digestive tract. Common scours may be caused by overfeeding of skim milk; by feeding from dirty pails; by feeding cold milk; by feeding soft, green alfalfa hay; by turning to pasture; or by overfeeding grain. This type of scours is noninfectious. It often appears in all calves in a herd at the same time because the same cause applies individually to all calves in the lot. Prevention or cure of scours from any of the above causes can be accomplished only by removal of the cause. Regardless of the cause, it is always advisable to cut down a little on the milk and the grain feed when the first symptoms of scours appear.

Scours caused by bacterial infection of the digestive system are the

more serious type They are more difficult to cure and require careful use of a strong intestinal antiseptic Infectious scours are recognized by the grayish white or bloody appearance of the dung and its strong odor As soon as a case of infectious scours is suspected, isolate the affected calves from the others and call a veterinarian to make sure of the diagnosis and to prescribe treatment Many calves die from infectious scours even though every possible effort is made to save them Recently, drugs such as aureomycin or the new types of sulfa have been found to be helpful in controlling infectious types of scours

Flies Spray walls and ceilings of dairy barns with lindane or methoxychlor mixed according to directions of the manufacturers Dairy cows may be sprayed once or twice per week with methoxychlor mixed according to directions Do not use DDT on dairy cows or in dairy barns because of possible contamination of the milk

4 Maintaining the Health of Beef Cattle

Probably because beef cattle spend so much time outdoors, they are comparatively free from diseases causing heavy losses Most of the ailments that caused heavy losses are now successfully kept under control Beef cattle are seldom infested with internal parasites that cause any great amount of trouble The cattle grub may be considered one exception Some external parasites often do cause considerable trouble

The diseases and parasites discussed here constitute those most frequently encountered in the care of beef cattle All may also occur in dairy cattle.

Tuberculosis. Tuberculosis was for years the most serious and costly communicable disease of cattle No practical cure for it has been discovered Partly because tuberculosis of cattle is so costly to cattle producers and partly because it is transmissible to people through uncooked meat and raw milk, the United States government and all state governments for many years have centered much attention on the eradication of this disease Since 1900 two reliable methods of testing cattle to detect the presence of tuberculosis have been perfected for use by veterinarians

The eradication of tuberculosis was begun by testing purebred herds and making laws requiring the testing of purebred cattle for freedom from tuberculosis infection before they could be shipped from one state to another for breeding use The next step was the area testing plan by which all the cattle in one county after another were tested and those

found to be infected were slaughtered. Now every head of cattle kept for breeding use in the United States has been tested. By this area-testing plan, the number of cattle in the country affected with tuberculosis has been reduced to less than one-half of 1 per cent.

This dread disease is still a menace. Every cattle producer should practice faithfully the precaution of having his herd tested once a year so that any animals reacting to the test may be eliminated before the disease has a chance to spread through the herd. All cattle purchased to be added to a breeding herd should come from a tuberculosis-free accredited herd that was tested within a year or should be tested before being added to the herd.

Splenetic Fever, or Texas Fever. Splenetic fever, or "Texas fever" as it is usually called in the Southern states, is a disease that for years caused untold losses to cattle raisers in the southern states. It is now so nearly eradicated from the country that its symptoms are seldom seen except in a few small areas. The principal symptom is a high fever accompanied by loss of appetite, listlessness, and in time a run-down condition. Young animals usually recover, but mature animals usually die. Once young animals have contracted the disease and recovered, they are immune for the rest of their lives. That was why it was possible to raise cattle with considerable success in infected areas but disastrous to ship cattle from the infected to noninfected areas or to ship northern cattle into the southern infected areas.

Research conducted over a period of years by veterinarians working in the employ of the U.S. Department of Agriculture, Bureau of Animal Industry, finally located a species of cattle tick as the sole carrier of the disease. Repeating dipping of cattle at 2-week intervals for a period of several months, on the area plan, has now brought about almost complete eradication of the cattle tick and with it the elimination of splenetic fever from the country. The disease is still a menace but no longer the serious one that it once was. Cattlemen in areas formerly infested with ticks should be on the alert for ticks or symptoms of splenetic fever and call a veterinarian at the first suspicion of it.

Foot-and-mouth Disease. The external symptoms of this disease are sores appearing on the lower extremities of the legs, between the toes, in the mouth, on the tongue, and on the lips of cattle. Usually, it does not prove fatal, but because cattle cannot eat during the time when the disease is running its course they lose weight and become emaciated. Recovery is slow. Loss due to shrinkage in weight is very heavy.

There have been several outbreaks of the disease at different times in small areas in the United States It has always been prevented from spreading by strict quarantine of infected areas and slaughter of all cattle affected with it It is to be hoped that this disease will never get a foothold in this country Naturally, the first step in case foot and mouth disease is suspected is to call the veterinarian

Anthrax Anthrax is a highly fatal disease It is prevalent in a few areas only and is being kept under control by quarantine when out breaks occur It is successfully prevented by vaccination with a serum that produces immunity Should you be located in an area where anthrax is known to exist consult the veterinarian for the necessary pre cautionary measures to be taken

Blackleg Blackleg is a disease similar to anthrax in many of its symptoms Like anthrax it is prevalent in certain areas and seldom found in others It is usually fatal to affected animals It is success fully prevented by vaccination with an approved vaccine Usually this is best done at three to four months of age Should you be located in an area where blackleg is known to exist consult the veterinarian he will prescribe the necessary precautions to be taken

Hemorrhagic Septicemia Influenza Pneumonia The three diseases hemorrhagic septicemia (also called shipping fever) influenza and pneumonia have much the same symptoms It is often difficult even for the veterinarian to diagnose them in their early stages Each is thought to be caused by several different kinds of bacteria that affect the respiratory organs although in septicemia the lungs may not be affected The most noticeable symptoms are running at the nose frothing at the mouth difficult breathing loss of appetite and taking positions either standing or lying down which indicate that breathing is painful Sometimes the digestive system displays an overlaxative and sometimes a constipated condition All these ailments are most likely to appear during seasons of rainy chilly weather or when cattle are housed in damp poorly ventilated barns

The most effective method of controlling all three of the troubles is to do everything possible to prevent them by good care and by pro viding dry well ventilated shelters or barns The moment the above symptoms appear in one or two animals in a group isolate those animals from the group and give the best daily care possible Medi cines seem to be of little value in treating respiratory diseases but if an infection seems to be spreading in a herd call the veterinarian A

vaccine has been developed that is believed to be helpful in preventing the development of hemorrhagic septicemia if it is given during the early stages of an infection.

Actinomycosis, or Lumpy Jaw. The symptoms of actinomycosis, or "lumpy jaw" as it is commonly called, is a swelling or large lump about the throat and lower jaw of the animal. It is a fungus growth that attacks both the fleshy tissues and the bones. While not readily transmitted from one animal to another, there is some transmission of the disease by animals eating feed on which the discharge from an infected animal has been dropped. If animals of ordinary value develop the disease, send them to market. These animals are slaughtered under rigid inspection, and in some cases the entire carcass is condemned and not used for human food.

Treat valuable animals during the early development of the disease by having the entire growth or lump removed surgically by a veterinarian. In advanced stages, surgery is not possible. Such cases are sometimes cured by treating the animal internally with potassium iodide. For the size of dose and length of time to continue treatment, follow the directions of a veterinarian.

Pinkeye. Pinkeye is an infection of the eye causing watering and pus formation. In severe cases, a grayish ulcer forms on the eyeball, making the animal temporarily blind. The disease usually occurs during the summer months when cattle are on pasture. In large herds of cattle or on ranches, it is difficult and costly to try to treat each animal. In such instances, the disease is often allowed to run its course without any treatment. It will do little permanent harm, except that an occasional animal may become permanently blind in one or both eyes.

In smaller herds, place affected animals in a darkened barn, bathe their eyes twice each day with a boric acid solution, and put several drops of argyrol solution into each eye with an eye dropper. Considerable success is met in checking the spread of the infection and preventing any permanent blindness if this treatment is administered. Solutions of sulfa or other drugs may be used for treating pinkeye, under the direction of a veterinarian.

Bloat. Bloat is the formation of gases in the digestive tract more rapidly than they can be absorbed. It is due to the action of bacteria on the contents of the digestive system. It occurs when there happen to be a large number of bacteria and a large supply of material suitable

for them to work on in the digestive tract This condition often prevails when cattle are receiving a heavy grain ration or when they are allowed a big fill of certain green feeds, particularly wet legumes Many cases of bloat could have been avoided by preventing the animal from getting an unusually large feed of grain or going onto a fresh pasture with its digestive system empty A feed of dry hay before turning cattle to pasture and a supply of hay in racks helps to prevent bloat Pastures of grasses and legumes, rather than pure legumes, are less likely to cause bloat

Mild cases of bloat usually need no treatment whatever Treat more severe cases by giving the animal 2 oz of turpentine given in a capsule with a capsule gun or by mixing the turpentine in a pint of milk or cold water and administering it as a drench Extremely severe cases may require puncturing the abdomen at the point of greatest swelling just beyond the outer edge of the left loin This is best done with a trocar and cannula or in emergency cases with the blade of a pocketknife Such treatment allows the gases to escape quickly and may be the only chance to save the life of the animal

Foul Foot, or Hoof Rot. This condition, frequently called "foot rot," is caused by a bacterium that enters into the tissues of the feet through scratches or cuts It is most likely to appear during the hot summer months when cattle stand around in mudholes or in muddy barnyards The infection causes inflammation, swelling, and pus formation and is accompanied by severe pain and lameness If allowed to go untreated, it may cause the loss of the entire hoof It is often troublesome in fattening lots, where a large number of cattle may become infected

If only a few animals are infected, catch each animal and hold securely, preferably in a bull stocks while the foot is lifted and trimmed, washed out thoroughly with warm, soapy water, and treated with a strong solution of stock dip or copper sulphate It is desirable to pack pine tar between the toes and to bandage the foot to keep the tar in place for several days This treatment will usually destroy the infection and heal the foot Remove cattle from the muddy areas

If a large number of mature cattle are affected with hoof rot, the recommended treatment is to build a low, flat bottomed vat about 3 ft wide and 6 to 10 ft long Place a strong dip solution, or a solution of copper sulphate, in it, and drive the affected cattle through it once a day until their feet are cleared of the infection and healed Recently,

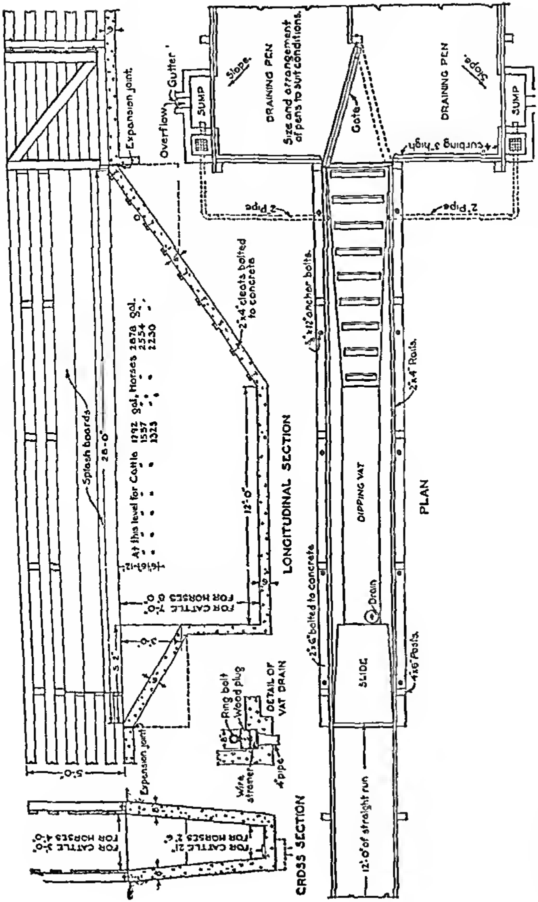

Fig. 184. A concrete dipping vat for cattle, especially designed for range conditions. *(Farmers' Bulletin 1584, U.S. Department of Agriculture.)*

certain sulfa drugs have been found to be effective if given to animals with hoof rot Use these under the direction of a veterinarian

Ox Warbles, or Cattle Grubs. The ox warble, often called the "cattle grub," is the larval stage of either one of two species of large

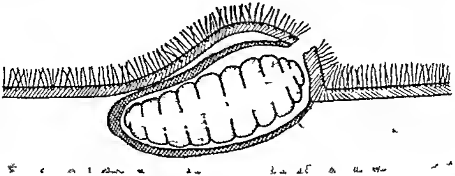

Fig 185 The cattle grub as it appears beneath the skin shortly before emerging (*National Livestock Loss Prevention Board*)

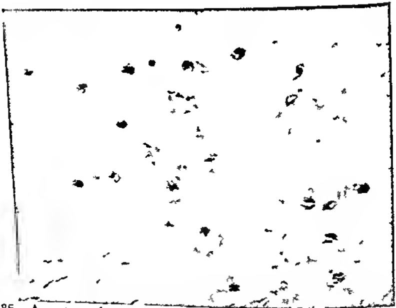

Fig 186 A portion of a hide showing the damaging effects of cattle grubs or ox warbles Cattle grubs made the holes which greatly reduce the value of the hide This parasite also causes millions of dollars worth of damage to cattle each year in the form of unthriftiness lowered milk production, and damaged carcasses (*National Livestock Loss Prevention Board*)

flies The ox warble flies are prevalent throughout the United States but seem to infest cattle in certain areas more than in others Some areas seem to be entirely free of them

The flies deposit their eggs on the hair of cattle, usually about the

heels or lower regions of the legs. The eggs hatch and the small larvae burrow through the skin, then travel beneath it to the region of the throat, where they remain for a time. They then move on to the back, where they lodge in the tissues just beneath the skin and form a lump or swelling. This lump varies with the size of the grub. The grub grows to be nearly an inch long and almost as large around as a lead pencil. Soon after it has lodged beneath the skin on the back, it eats

FIG 187 Wyoming ranchers spraying cattle to control grubs Bunches of cattle are crowded into a narrow alley and men standing on catwalks handle the spray guns to apply the mixture of water and cube derris, and wettable sulphur A spray outfit capable of delivering high pressure is necessary (*The Farm Journal*)

a small opening through the skin In badly infested areas, it is not uncommon to find several dozen of the swellings on the back of each animal, each swelling indicating the presence of a grub The grubs cause irritation and restlessness among the animals to the extent that they become unthrifty If they are slaughtered during the season when the grubs are present on the back, the hides are reduced in value and the carcasses are less valuable because they must be trimmed around each of the spots where a grub is located.

Since the life history of this parasite is known and the flies are produced in no other way except by the hatching of the grubs that live over winter in the bodies of cattle, it is believed that it can be exterminated by systematic treating of the grubs to kill them before they hatch There are several methods of doing this

Hand Extraction In a small herd of cattle, squeeze the grubs out and kill them In doing this, examine cattle, beginning about Nov 1 in the Southern states and Jan 1 in the Northern states Examine them once every 2 weeks thereafter until all the grubs have been removed and killed In squeezing the grubs out, avoid crushing them under the hide

Oilcan Treatment Another treatment for small herds is to inject 15 to 20 drops of commercial benzol into each opening with an oilcan This kills the grubs Caution Keep benzol away from fire

Dusting Method Mix together by weight equal parts of finely ground derris or cube powder (containing 5 per cent rotenone) with wettable sulphur Remove the lid of a screw-topped jar, punch about 25 quarter inch holes in the lid to make a shaker, and into this put the powder In applying, hold the shaker about 3 in above the back, move the shaker slowly, and follow the shaker with the free hand, using a rotary motion with the finger tips, thus rubbing the hair lightly to ensure getting the powder into the grub openings Repeat this treatment every 30 days as long as the grubs show in the back One pound of dust will treat about 15 head of cattle

Scrubbing Method Make a paste of 12 oz of cube or derris powder (containing 5 per cent rotenone) plus 6 oz of wettable sulphur Add about 1 gal of water Smear this over the back of the animal, and rub it in with a stiff brush The amount indicated is sufficient to treat 12 to 16 head of cattle

Spraying Method For treating large herds of cattle such as range herds, mix 5 lb of cube or derris powder (containing 5 per cent rotenone) with 10 lb of wettable sulphur and enough water to make a thin paste Add water until the total mixture amounts to 100 gal Spray this solution over the backs of the cattle While treating the cattle, crowd them into small enclosures, or pass them through a suitable chute Apply the material with an orchard type of spray outfi that will maintain a pressure of 375 lb or more (see Fig 187)

In infested areas, it pays each farmer or rancher to treat his cattl to rid them of the grubs It is believed that unified effort by all farmer

or ranchers in a community to exterminate the grubs from all the herds would eradicate this parasite from the area so that in time the entire country could be freed from it.

Warts. Warts frequently appear on the skin of cattle. The cause is not well understood, but they are thought to be due to malnutrition of the skin. Treat warts as soon as they appear. Otherwise, they may become so thick and numerous as to interfere with the thrift of the animal, and they are always unsightly. They will usually disappear if soaked with olive oil or castor oil once every day or two for several weeks. They may also be removed by cutting them off, but removal by surgery should be done by a veterinarian.

Mange. Mange, or "cattle scab" as this parasite is sometimes called, is a small parasite that lives on the skin of cattle. There are several varieties of mange mites. Because the mites are so small and burrow deeply into the skin, they may be present in a herd of cattle for weeks before they are discovered. The first symptoms are cattle rubbing on fence posts or any object they can find. The rubbing is due to irritation caused by the mange mites. As soon as the caretaker observes several cattle in a herd rubbing themselves repeatedly, he should first examine them carefully to see if he can find lice, for these might be the cause of the rubbing. If lice are not found, it is advisable to call the veterinarian and have him check to see if it is mange that is present.

One effective procedure to eliminate a mange infestation from a large herd is to put the entire herd through a dipping tank containing a carefully prepared solution that kills the mange mites. One dipping may kill all the mites, but to make certain two treatments are advised, the second following 10 to 14 days after the first.

Several different dip preparations are used in the treatment of mange. The one formerly recommended is called the "lime sulphur dip." However, new chemicals like benzene hexachloride and lindane are coming into use for dipping, as further explained on page 298.

For use on a single farm or large cattle ranch, a concrete dipping vat as shown in Fig. 184 is desirable. A concrete draining floor should be provided at the exit end to catch the drainage from the cattle as they leave the vat and carry it back into the vat. The vat must be equipped with a strong, narrow chute at the entrance end, and there should be a strong fence around the draining floor at the exit end. The equipment must be large enough to accommodate full-grown

animals but to conserve on the amount of dip required should be no larger than necessary The depth of the dip solution must be such that, when the largest animals slide into the tank, they will be completely immersed They then swim a few feet, until the front feet reach the exit incline, and walk out If the weather is extremely hot dipping should be done toward evening If it is cold, cattle should be kept in a shed or barn until they have thoroughly dried off Benzene hexachloride (BHC) is effective in the control of mange on beef cattle Mix according to directions of the manufacturer, and apply as a spray by using a power sprayer Lindane should be used for dairy cattle

Ringworm This is a variety of fungus that lives on the skin of cattle It is easier to eliminate than mange because it attacks the skin in spots only and usually affects the young animals in the herd first Ringworm appears as a small, circular, cheeselike scab, usually about the head and neck of the calf If treated as soon as the first of these spots appear, it can be quickly and easily eliminated If allowed to go untreated, it may spread throughout a herd and cause an unthrifty condition in the cattle

Scrub off the cheeselike scab over the affected area with a stiff brush used with warm water and a mild soap Paint the spot with tincture of iodine One treatment will usually eliminate the affected patch, but watch animals closely, for other patches may show up later Treat them in the same way until the infestation is eliminated

Lice Several varieties of lice live on cattle Their presence should be suspected as soon as cattle show signs of rubbing themselves or if the hair starts to come out around the tailhead or along the back where lice usually infest the animal Lice can be detected by carefully inspecting the suspected area on the body They are large enough to be seen without the use of a microscope

Lice are easily eliminated by spraying or washing cattle with an ordinary coal tar disinfectant solution If a dipping vat is available, put the cattle through it using the disinfectant solution in the vat Repeat the treatment in 10 to 14 days Preparations to use in solutions for the elimination of lice can be purchased from almost any drug store or stockmen's supply house Use them according to instructions on the container

One application of lindane as a spray will control lice on cattle Methoxychlor is also effective Follow directions of the manufacturer

Lice are more of a problem in winter in northern areas where cattle

are housed a good part of the time. They often begin to appear during December. Many cattlemen believe that there is too much risk of causing colds and pneumonia in using the wet dips for the elimination of lice during the winter months. In such a case, use a dry mixture of one part powdered sabadilla seed and one part flowers of sulphur dusted along the back, over the neck, about the horns, and about the tailhead. Apply two treatments, one in December and another in February. Five pounds of the powdered sabadilla seed and 5 lb. of sulphur will be enough to give 100 head of cattle one treatment if the powder is not wastefully applied.

Another effective powder for cattle lice is a mixture of one part of cube or derris powder (containing 5 per cent rotenone) with three parts of flour. Repeat the treatment in 14 days.

Several commercial louse powders are available. The most effective ones contain cube or derris powder (or rotenone), pyrethrum, or nicotine.

5. Maintaining the Health of Sheep

If it were not for the parasite problem, the maintenance of the health of sheep would be simpler than that of cattle or hogs because sheep seem less susceptible to contagious diseases than either of the latter. Sheep may be affected with tuberculosis, brucellosis (abortion), anthrax, foot-and-mouth disease, and several other diseases similar to those affecting cattle. Serious outbreaks especially of tuberculosis and contagious abortion are very rare, however, and give the sheep caretaker little concern. On the other hand, several internal as well as external parasites that may be very damaging do infest sheep, and it is important to be continually on the lookout for them. The sheep raiser should be encouraged by the fact that parasites are seldom fatal and also that by proper measures all of them may be kept under control and eliminated from a flock in a comparatively short time without sacrificing breeding stock. Diseases and parasites for which the sheepman must be on the watch and against which he must take the necessary preventive and control measures are discussed in the paragraphs that follow.

Paralysis in Pregnant Ewes. This disease, often called "pregnancy disease," does not cause large losses to sheep raisers, but it occurs in many different parts of the United States and in many other countries. It may occur in a flock one year and not appear again for several years.

It affects only ewes that are pregnant and due to lamb in 6 weeks or less Symptoms are that the ewe becomes dull and listless, does not care to eat lies down most of the time, gets to her feet with difficulty at first, and then becomes paralyzed and is unable to get up at all The lambs are usually born a few days early The affected ewes are nearly always carrying twin or triplet lambs which are usually born dead Some ewes die before lambing, some shortly after lambing and some recover

The exact cause of pregnant ewe paralysis is not known, although it is thought to be caused by faulty nutrition The feeding of well balanced rations containing, especially, sufficient protein and calcium together with plenty of exercise, by the ewes during the period of pregnancy, seems to help prevent this disease In some instances, the feeding of sugar or molasses is thought to check the development of paralysis in ewes that seem to be threatened with it It may therefore result even from a deficiency of carbohydrate compounds in the ration During the last 6 weeks prior to lambing, feed some grain in addition to good-quality legume hay In long, cold winters with deep snow, it may be necessary to drive the ewes a half mile and back to make sure they are getting enough exercise No treatment has been discovered that will cure the disease once a ewe has developed the paralyzed condition

Pneumonia and Colds Sheep and lambs are subject to taking cold and to contracting pneumonia Trouble from these ailments is usually the result of poor shelter, where sheep become soaked with rain or snow and are then allowed to remain out in the wind or are crowded together in a damp shed without dry bedding The condition is aggravated if sheep are at the same time poorly fed and in thin flesh The only preventive measures are to provide suitable sanitary shelter and to feed well enough to maintain good general thrift and vitality in the flock Sheep shorn in winter or early spring are likely to take cold or contract pneumonia if they are not kept warm and dry

Nutritional-deficiency Diseases There are several readily recognized nutritional deficiency diseases in sheep One is the iodine deficiency often noted in young lambs born with goiter swellings on their throats Many such lambs die Some goitered lambs may be helped by painting the swelling with tincture of iodine The deficiency generally appears only in the iodine deficient areas of the country and on farms where poor feeding is practiced Prevent iodine deficiency by feeding com

mercial iodized salt or by thoroughly mixing 1 oz. of powdered potassium iodide crystals with 100 lb. of salt and using this salt instead of plain salt for the flock.

Sore Eyes. Sore eyes are experienced chiefly in young lambs in those breeds of sheep which have dense wool covering the head and face. For some unknown reason, the eyelids in young lambs of such breeds are often turned under at birth. The eyelids of all lambs in these breeds should be examined shortly after birth; if they are turned under, they should be turned back and a drop or two of silver nitrate ointment or argyrol solution placed in each eye. This will counteract the irritation to the eye until the eyelids become adjusted to their normal position. In some lambs, the eyelids must be operated upon by cutting out a narrow strip of skin below the eyelid, then drawing the cut edges together with one or more stitches using a silk thread. This pulls the eyelid back and prevents the hair and wool from irritating the eyeball as it will if the lid is allowed to continue in the turned-under position. Failure to treat the eyes of young lambs that do not adjust themselves will result in some cases of blindness.

Sore Mouth. Sore mouths are sometimes noticed, especially in lambs up to about six months old. They may be caused by grazing in stubble fields; in such cases they heal quickly when the stubble grazing is discontinued.

Sore mouths are also caused by an infection that forms small ulcers similar to those of necro, or sore mouth, of pigs. In small groups of lambs, rub off the scabs and treat the sore spot with tincture of iodine or a strong dip solution; this treatment will cause quick healing. The procedure is tedious when large numbers are involved, but it is about the only way to eliminate the infection quickly. Vaccination has been found to give protection against sore mouth.

Constipation. Young lambs are frequently affected with constipation. Occasionally, this trouble occurs in older sheep, especially if they are being maintained on dry, coarse roughage as their only feed. Give two teaspoonfuls of castor oil to the young lamb and two to four tablespoonfuls to older sheep according to their size. The oil can be given successfully with a spoon by catching and holding the sheep carefully while the oil is placed well back in the mouth with the spoon.

Infections of Udder and Teats. Some ewes milk very heavily shortly after lambing. They are subject to about the same udder troubles as dairy cows. Swollen, caked udders and sore teats are common.

Often a heavy milking ewe will produce more milk than her lamb can take In this case milk out part of her milk by hand for the first few days after lambing If the udder of the ewe seems hard and swollen following lambing, bathe it two or three times a day, for 1 to 3 days, with water as warm as the hands can stand The use of certain sulfa drugs has helped in some cases where udder infection is involved Treat sore teats by smearing them with carbolized or medicated vaseline

Bloat Growing lambs or mature sheep are subject to bloating just as are cattle and from the same causes—heavy grain feeding or pasturing green legumes Give one tablespoonful of turpentine in a pint of warm milk or water, this usually relieves a case of bloat Should a sheep be discovered in severe distress from a bad case of bloat, puncture the paunch with a trocar and cannula or a pocketknife at the point of greatest distention just below the left loin Mild cases of bloat require no treatment

To help prevent bloat, give sheep a full feed of hay before turning them onto pasture Pastures which are mixtures of grasses and legumes are less likely to cause bloat than pure legumes

Foul Foot, or Hoof Rot If pastured on low, wet land or allowed to stand in filthy, muddy barnyards or sheds, sheep sometimes pick up an infection commonly referred to as "foul foot" or "hoof rot" This is caused by a bacterium that gets into the flesh through a cut or scratch between the toes or at the crown of the hoof It causes inflammation, pus formation, and severe pain Only one foot or all four feet may be affected The pain is often so severe that the animal will not attempt to walk Hoof rot is seldom encountered if sheep are kept in sanitary surroundings and pastured on clean, well drained pastures

If only a few sheep are affected, catch each sheep, dip the feet in a strong disinfectant solution and smear pine tar between the toes and about the hoof head If a large number of sheep are affected, a shallow, panlike vat must be built a strong disinfectant solution placed in it to a depth of about 2 in, and the sheep driven through it Treatments, whether by hand or by driving through the disinfectant solution, will need to be repeated every day or two until the infection is destroyed and lameness disappears Sulfa drugs may be used in treating sheep which have hoof rot Use these drugs under the direction of a veterinarian

Maggots. During the fly season, an occasional sheep becomes infested with maggots or the larvae of certain species of flies that deposit their eggs in collections of filth in the wool. The eggs hatch and the larvae find their way down to the skin under the filth collections, working through the skin and into the flesh. An infestation of maggots may easily be detected in the early stages by the squirming, twisting movements of the sheep, attempts to rub or bite at the infested area, and a general appearance of distress. If maggots are suspected, catch the sheep and examine it closely for their presence. If they are found, clip the wool from the infested area and apply gasoline, ether, or

FIG 188 A system to save time in drenching sheep for parasites (*Minnesota Experiment Station*)

chloroform. Screwworm Smear EQ355 is very effective in control of these larvae. Secure it from a veterinarian or elsewhere, and follow directions on the package.

The Stomach Worm. This parasite is probably responsible for a greater loss to sheep raisers throughout the world than any disease or any other parasite of sheep. It is prevalent in all locations except the dry semiarid range areas, where sheep are generally free from it. The reason why range sheep are not infested is that the range type of grazing is not suited to the completion of the life cycle of this worm and that range sheep seldom graze the same area more than a day or two at a time.

The mature stomach worm is about 1 in. long and as big around as a pin. When observed in the digestive tract, it is pink to reddish in color because it lives by attaching itself to the lining of the stomach and intestines and sucking blood. The female stomach worms deposit millions of eggs in the digestive tract. These eggs are passed out of the body with the dung and may lie dormant on the ground for many months. When conditions are right, the ground damp and the sun warm, the eggs hatch and the young worms attach themselves to the grass, where they can live for a time. Later they are taken into the mouth by the sheep when grazing on infested pastures.

FIG 189 Parasite control made the difference. The two lambs were by the same sire and out of related dams At the age of about nine months, the untreated lamb at the left weighed 42 lb , the treated one at the right, 130 lb (*Michigan Experiment Station*)

Stomach worms are most damaging to young lambs. Symptoms of a heavy infestation in a lamb or sheep are an unthrifty, thin appearance, scouring, or continual diarrhea, pale skin, paleness of the eyelids, and sometimes swelling under the jaw. The only way to solve the stomach worm problem permanently is to try to rid the flock and the premises on which sheep are kept of the infestation.

A good pasture program aids in checking a build-up of stomach worms. If sheep graze over wide areas, as on the range pastures, there is little danger of serious infestation. Small pastures should be rotated annually, and preferably at intervals during the grazing season.

For the control of common stomach worms and nodular worms, a new drug called "phenothiazine" (PTZ) has been found to be very effective The recommended procedure is to drench the breeding flock with a mixture of phenothiazine and water twice during the year, once in the fall, and again in the spring prior to going to pasture For this purpose, secure the form of powdered phenothiazine which has a wettable agent added so that it will mix with water Make the mixture, and use in doses according to the directions of the manufacturer For drenching, use a drenching syringe or a drenching bottle Instead of drenching, phenothiazine pellets or boluses may be administered to individual

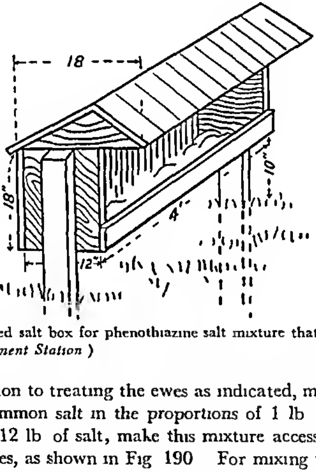

Fig 190 A covered salt box for phenothiazine salt mixture that keeps out the rain (*Minnesota Experiment Station*)

ewes In addition to treating the ewes as indicated, mix phenothiazine powder with common salt in the proportions of 1 lb of phenothiazine powder to 9 to 12 lb of salt, make this mixture accessible to ewes and lambs at all times, as shown in Fig 190 For mixing with salt, use the phenothiazine powder either with or without the wetting agent

The Tapeworm The tapeworm of sheep is a large, long worm infesting the small intestine It lives by feeding on the contents of the intestine Damage is done principally by its getting into the bile duct and openings from the pancreas into the intestine By obstructing these ducts, their normal functioning is prevented and the health of the lamb is impaired Treatment for tapeworms is difficult Secure the advice of a veterinarian if the sheep become infested with tapeworms

The Nodular Worm This is a short, thick worm that lives in the small and large intestines It has the peculiar characteristic of attaching itself to the wall of the intestine, following this, a hard crust is formed around it The worm then dies, leaving a small, hard lump, or "nodule as it is called, in the wall of the intestine The nodules make the intestine unfit for the sutures used by surgeons or for sausage casings This detracts appreciably from the value of the lamb or sheep, as surgical sutures and sausage casings made from the intestines are important by products from the slaughter of sheep

Once the nodular worm attaches itself to the wall of the intestine, it is destined to die and cause no more trouble Lambs become infested when running with infested sheep that pass the nodular worm eggs in their feces The eggs or young larvae are picked up by the lambs, and the worms develop in the intestines of the lambs Until recently, there seemed to be no effective treatment for this parasite During the last few years it has been found that phenothiazine is effective in eliminating the live, free worms from the digestive systems of sheep The method of treatment is given in the section on stomach worms

The Liver Fluke This is a parasite found in the liver and bile ducts of sheep There is no treatment or control measure for it except pasture rotation It is not a serious sheep parasite except in low, wet areas The only areas in the United States where it is troublesome are in the southeastern coastal regions

Sheep Ticks The sheep tick is a large insect that lives in the fleece It works its way down through the wool and lives by biting into the skin and sucking blood Nearly every flock of sheep anywhere in the United States will sooner or later become infested with sheep ticks if the flock is not treated regularly to eradicate them Good care of a flock of sheep requires that all sheep in the flock be dipped once each year to make sure that any ticks present will be destroyed regardless of how few there may be There are a number of stock dip or sheep dip preparations that are effective in destroying them Put the entire flock through the dipping tank within a few days following shearing each spring Lambs must be dipped for if the flock is infested the ticks leave the ewes and concentrate on the lambs following shearing

Some dip preparations are effective in destroying the tick eggs as well as the ticks If such a preparation is used one dipping is enough If a dip that destroys the ticks but not the eggs is used, a second dipping

10 to 14 days after the first must be made. Arsenicals, BHC, lindane, and toxaphene are some of the effective materials from which a choice may be made for making a mixture for dipping. Follow directions of the manufacturer. On any farm where a good-sized flock is maintained year after year, it will pay to build a dipping tank so arranged that the sheep can be driven through it. It is especially important that a draining floor be provided at the exit end of the tank, for sheep carry much of the dip solution out of the tank with them. Most of it will

FIG. 191. A tank for dipping large numbers of sheep. (*U.S. Department of Agriculture.*)

drain out of the fleece quickly and back into the tank, if the draining floor is properly constructed. This will reduce the amount of dip solution required and hence lessen the cost of dipping.

Usually one dipping per year is enough to keep a flock free of ticks. Every sheep raiser, however, should examine a number of sheep for the presence of ticks early in the fall, and if any considerable number are found the flock should be dipped again before cold weather begins.

In some areas where flocks are small, it may pay better for a number of flockowners to cooperate in securing a dipping tank that can be

placed on a truck and taken from one farm to another, rather than for each to go to the trouble and expense of providing a tank of his own. A portable dipping outfit is shown in Fig. 192.

Wettable DDT, lindane, or toxaphene may be mixed according to directions for use as a spray when the wool is short. Rotenone, DDT, or lindane may be used as a dust treatment in cold weather. In using these materials, follow the directions of the manufacturer.

Lice. Several varieties of lice infest sheep. They are successfully kept in check by the dipping used to eliminate ticks.

Sheep Scab, or Mange. Sheep, like cattle, are infested with several types of mange mites. Mange in sheep ordinarily is shown by patches

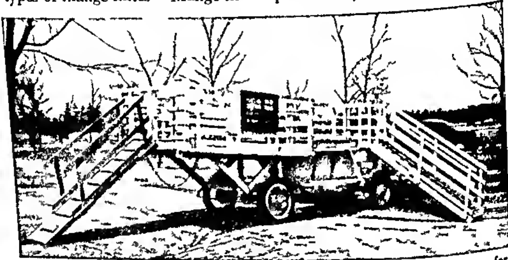

FIG. 192. A portable dipping outfit to make available community dipping service for sheep. In some localities these outfits are provided by departments of vocational agriculture. (*Michigan State College.*)

of wool dropping off, revealing a scablike patch of skin over the bare spots. Mange in sheep is a damaging parasite and must be eradicated as soon as it is detected, or it will become very costly to the sheep raiser. As soon as sheep are observed trying to rub themselves continually, examine them carefully. If mange is found, dip the flock with BHC mixed according to directions of the manufacturer. Fortunately, mange has been largely eliminated from sheep in most parts of the United States. Sheep infested with it are quarantined by state livestock sanitary boards until the infestation is eliminated.

6. Maintaining the Health of Horses and Mules

The maintenance of good health and soundness of wind and limb in horses or mules was considered by pioneer "horse doctors" to be the

most important duty. In the so-called "horse-and-buggy days," when horses provided all the power for farm operation and short-distance transportation, each horse was highly valued, and the importance of saving his life in case of injury or sickness and of keeping him sound and ready to work was fully realized by his owner. As a result, the veterinarian would be promptly called to minister to the needs of a sick or injured horse. In those days, other farm animals had a lower commercial value, and seldom was it considered profitable by the farmer to call in a veterinarian to look after their health. Early veterinarians knew little about the health problems in farm animals other than the horse and mule.

A change has taken place to the extent that the veterinarian now finds his services confined largely to classes of farm animals other than horses and mules. This is due to the increase in numbers and values of other farm animals and to knowledge gained concerning treatment of various diseases and control measures to prevent them. A decrease in the number of horses and a decline in the value of a horse or colt are contributing factors.

However, horses and mules are still subject to injury from many causes and to all the diseases that formerly gave trouble. The horse or mule raiser or any one using horses and mules must give as much attention as ever in an effort to avoid loss from injury and disease and to keep his animals sound.

Horse and mule diseases and health problems most likely to occur are discussed in the paragraphs that follow.

Abortion. Abortion, or premature expulsion of the fetus, is one of the most troublesome and costly problems confronting the horse or mule raiser. Abortion is caused by a bacterium infecting the reproductive organs of the mare. The disease is most disastrous on farms where a number of mares are bred each year, for on such farms it is likely to spread to most of the mares, causing them to lose their colts. On farms where only one or two mares are bred each year the disease is not so likely to occur. If it does, it is not so serious, for by waiting a year after the mare has aborted before breeding her again the infection should disappear from the farm.

There is no known cure or certain preventive measure for abortion. The best procedure in attempting to eliminate it from a farm on which a number of mares have aborted is to practice the best sanitation possible, have all mares examined by a veterinarian before mating them, and then mate only those whose reproductive organs appear to be in normal

healthy condition In a locality where abortion is prevalent, the sheath of the stallion should be washed with a mild disinfectant solution following the serving of each mare This will help to prevent transmitting the disease by the stallion

Abortions in mares also come from injuries and causes other than the infectious bacterium, but such cases are rare Whenever a mare aborts especially if two or more abort on the same farm during one year, the infectious cause should be suspected and the veterinarian called Fortunately, infectious abortion does not seem so prevalent among mares at present as it was 10 to 30 years ago

Navel Ill This is a costly infectious disease due to one or more kinds of bacteria that infect the colt at birth or soon after birth Symptoms are that the colt appears dull and pus may or may not appear about the stub of the navel cord Swellings soon appear in one or more of the joints indicating that the infection has been carried through the body by the blood stream

Prevention by careful sanitation in surroundings at foaling time and treatment of the stub of the navel cord with a mild disinfectant solution or powder offers the largest opportunity to control the disease The care of the newborn foal is discussed in Chap 5 Vaccines have been made that if injected into the colt soon after birth may help to prevent the development of the disease During recent years the sulfa drugs have been used as a curative agent with some success As soon as the first symptoms of a case of navel ill appear in a colt call the veterinarian for the diagnosis and treatment If allowed to run its course the disease is highly fatal and the few cases that do recover result in crippled colts that are usually worthless

Sleeping Sickness This disease has been encountered in various parts of the United States It is periodic in occurrence and usually limited to regional outbreaks The last serious outbreak occurred in the summer of 1937 and was confined to the central northwestern and western Canadian regions of the continent It is thought that the disease is caused by a virus believed to be carried by mosquitoes and that horses become infected by being bitten by the mosquitoes The disease appears during the summer months or mosquito season and horses that are in pasture or regularly turned to pasture each night are most likely to be infected

Symptoms are that the horse appears dull and does not care to eat A little later it becomes wobbly in gait As the disease advances it

lies down and is unable to get up. In the advanced stage of the disease, the horse appears to be in a coma or unconscious. A fever running as high as 106° often accompanies this disease. If it is allowed to go untreated, the death loss may be as high as 50 per cent. By careful treatment, the death loss among affected horses may be kept below 25 per cent. Treatment consists in keeping the horse on its feet if possible, even by making use of a sling for this purpose. Offer cool water frequently in a bucket held high so that the horse can drink easily. Cold cloths or ice packs over the top of the head are beneficial. Treated in this way, horses will survive that would die if left lying in a stall without any treatment.

A vaccine for the prevention of sleeping sickness has been developed that is believed to be highly effective. In a region where sleeping sickness was prevalent the previous year, it is considered advisable to have all horses vaccinated with the preventive vaccine during the spring months. The vaccine gives immunity for 6 months to 1 year. Therefore, in infected areas vaccination each spring is recommended until such time as the disease has been absent from the area for 2 years.

Colic. Colic is not an infectious disease. The term is applied to almost any ailment of the digestive system that causes pain and discomfort to the horse. In such cases of indigestion, gas formation in the digestive tract is often the immediate cause of the discomfort. Treatment consists in giving the horse a physic. A quart of castor oil or 1 to 2 lb. of Epsom salts dissolved in water and given as a drench is the treatment commonly recommended. Unless the horse shows relief in 3 to 5 hr., call the veterinarian.

Azoturia. This condition is most likely to occur when horses accustomed to regular work and heavy feeding are allowed to stand idle in the barn for a day or two and are fed the same amount of feed as on workdays. It so often occurs on Monday mornings that it has been termed "Monday morning disease."

The symptoms are that the horse appears entirely normal and in good spirits when harnessed and taken out of the barn. Before traveling very far, it suddenly becomes dull and begins to tremble and perspire. If compelled to keep on walking, it soon becomes wobbly in gait and finally falls down and is unable to get up again. The first essential in treatment is to unhitch and unharness the horse as soon as symptoms indicate a probable case of azoturia and leave the animal right where it is for several hours. If this is done, many cases of

azoturia will correct themselves in a few hours without further treatment Symptoms of a severe case are that the horse goes down quickly and is unable to get up again It will usually struggle to get to its feet but is unable to do so As soon as symptoms indicate a severe case, call the veterinarian, though treatment of such cases is not very successful, most of them resulting in death The few horses that recover are practically useless for many months, for complete recovery is slow

Distemper, Colds, Pneumonia. These are all troubles affecting the respiratory systems of horses Symptoms are coughing, running at the nose, loss of appetite, difficult breathing, and a high fever Good care is the most important item in treatment, though in outbreaks of what appear to be severe colds in a number of horses in a group it is best to call the veterinarian Should the infection turn out to be distemper or pneumonia, he can prescribe relief measures that will speed recovery and possibly prevent death loss

Founder. This condition is an inflammation and congestion of the capillaries in the fleshy portion of the foot just above the sole It often appears in a horse that has been on heavy feed and at hard work It may also appear in mares following foaling The treatment prescribed is to make a soft mud bath and have the horse stand in it 2 or 3 hr at a time twice a day A better treatment is to place ice bags about each foot and keep them on the horse continually for 2 or 3 days

Horses usually recover from founder, but the condition remains chronic in a moderate form Those which have been foundered usually are sore on their feet when first taken out of the barn After walking ¼ to ½ mile, the circulation of the blood is speeded up, the congestion leaves the feet, and they will get along all right the rest of the day, only to be sore and lame again when first taken out of the barn the next morning Placing rubber pads between the shoe and the foot often helps horses suffering from chronic founder Founder in horses can be detected by lifting the front foot and observing the sole It always appears pushed down and full, rather than concave as in the normal foot

Ophthalmia, or Moon Blindness Horses sometimes become blind in one or both eyes owing to injury Care in handling them to avoid such injuries is, of course, the only preventive for such cases A more general cause of blindness is a disease of the eye called "periodic ophthalmia" or "moon blindness" This disease is not well understood

though it has existed among horses for many years. It is associated with low, wet soils and damp climates. It may be caused by a virus, though it is not readily spread from one horse to another. The symptoms are watering of the eye, followed by the forming of a grayish coloring over the entire surface of the eye. One or both eyes may be affected. In the early stages of the disease, the watering and coloring over the eye appear and last for a few days, then clear up, only to appear again at irregular intervals. In a few months, the affected eye becomes permanently blind.

There is no known preventive or cure of this disease. Fortunately, it is not widespread. It is thought that there is a tendency toward inheritance of the weakness that causes it to develop. In some cases, faulty nutrition is a contributing cause. Some experiments have shown that the vitamin riboflavin in the ration aids in preventing it in some cases.

Constipation. This trouble may occur in young colts during the first days of their lives or in horses at any age. In the young colt, it is caused by the retention of the collection of fecal matter present in the large intestine at birth. This type of constipation is relieved by injecting about 1 qt. of warm water into the rectum. Use a rubber tube and either a hot-water bottle or a funnel on one end of the tube for this purpose.

Constipation, or "impaction" as it is sometimes called, is most likely to occur when horses are being fed on dry, coarse feed and do not get much exercise. A liberal dose of 1 qt. of raw linseed oil or 1 lb. of Epsom salts dissolved in water and given as a drench is the treatment recommended. The feeding of one feed of boiled grain per week or the regular inclusion of 15 to 25 per cent of bran in the grain ration, especially when horses are idle, is a successful preventive of constipation.

Bots. The bot worm is the larva of a large fly. The fly deposits eggs on the legs and body of the horse. The eggs hatch, and the young larvae irritate the skin, causing the horse to rub the area with the nose or lick it to stop the irritation. In this manner the larvae get into the mouth and then on into the stomach. There they collect and grow in size throughout the winter months. Unless they are very numerous, they cause little or no trouble. In heavy infestations, they collect about the entrance to or exit from the stomach and interfere with its normal functioning and with normal nutrition.

The presence of bots in sufficient numbers to cause trouble may be

suspected in areas known to be heavily populated with the botfly. Symptoms are an unthrifty condition in the horse during the winter months when all other factors that might cause such a condition have been eliminated. If bots are suspected, call the veterinarian. If he finds evidence that bots are present, ask him to prescribe treatment to eliminate them. One treatment the veterinarian may use is to give

FIG 193 Bots may cause considerable damage to horses Here many of them in the larva stage are attached to the lining of a horse's stomach The presence of large numbers cause unthriftiness in the horse (*U.S Department of Agriculture*)

each horse a dose of carbon bisulphide in a gelatin capsule. This material is usually administered in December or January.

Worms. Several forms of worms infest the digestive systems of horses. They are seldom troublesome to mature horses. Foals pasturing on closely grazed low-lying pastures often come in, in the fall, with their digestive systems so heavily infested with one or more varieties of worms that they will remain unthrifty throughout the winter. Whenever a young foal or yearling colt does not respond to good winter

feed and continues unthrifty, a worm infestation is likely to be the cause. Treatment with carbon bisulphide, as for bots, is effective.

Lice. Several varieties of lice also infest horses. Their presence will also be evidenced by rubbing. They are easily observed on close examination. Treatment to eliminate them requires washing with any standard stock dip preparations. Use two treatments 10 to 14 days apart to eliminate lice completely. Treatment with chlordane is effective; mix according to directions of the manufacturer.

Unsoundness. An unsoundness in a horse or mule is defined as any malformation or injury that destroys or detracts from the usefulness of the animal. A blemish is a scar or malformation that mars the appearance but does not interfere with the usefulness of the animal. There are many malformations and "aftereffects" of injuries and disease that result in unsoundness and many forms of blemishes. The more important of the unsoundnesses are those affecting the feet or bones of the legs, causing lameness.

Sidebones. The most common unsoundness of the feet and legs of the horse is the condition known as "sidebones." In this condition the small cartilage extending about to the top of the hoof on the sides of the foot is affected. Each horse has eight of these cartilages, one on each side of each foot. When in normal condition they consist of tough, flexible projections upward from the bottom of the foot. Their location usually cannot be detected by the eye; they are easily located, however, by pressing the thumb over the area between the top of the hoof and the bone of the pastern about midway between the heel and the center of the toe. From any one of many causes, one or more of these cartilages may become diseased. In the beginning of the development of the diseased, or sidebone, condition, the small blood vessels become congested. The area becomes inflamed, swollen, and painful when the horse walks or trots, especially on a hard surface. This is followed by the depositing of porous earthy or mineral substances in and about the cartilage. Hardening, or "ossification" as it is called, makes the cartilages firm, stiff, and bonelike. Following the ossification of a cartilage, the inflammation and pain may disappear, but the horse will probably always walk with a stiffened short step and if worked on hard streets will always experience some pain.

The development of the sidebone condition is thought to be due more than anything else to faulty shape of the entire foot structure. It therefore appears to be inherited. The condition itself, however,

is not inherited, for sidebones rarely develop in horses under two years old. To repeat, what is inherited is the weakness of the foot structure that leads to the early development of the sidebones when the horse is put to work. There is no known cure for the sidebone condition once it has developed. Good care and regular trimming of the feet of the growing colt so that the foot will develop its normal shape are thought to help to prevent the development of sidebones.

Discontinuing the use as breeding stock of stallions and mares that develop sidebones at an early age is recommended as the means of reducing this cause of unsoundness in horses to a minimum.

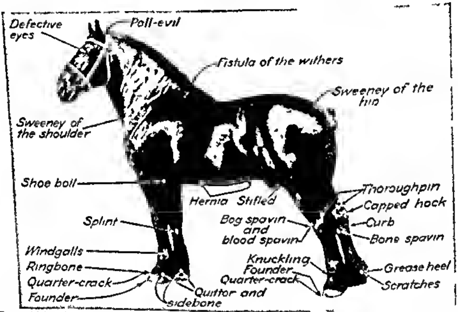

FIG 194 Locations of common unsoundnesses of the horse (*Michigan State College*)

Ringbone. The ringbone condition is a hardening of tissues in and about the joints of the pastern similar to the sidebone on the cartilage. It is not nearly so common as the sidebone, but when it does appear it often develops as a large, hard growth encircling the entire pastern. Besides causing pain and lameness, it becomes an unsightly blemish. There is no cure for ringbone once it has developed. Horses affected with it should not be used as breeding stock.

Bone Spavin. This is an ossification in and about the hock joint. Often there is very little enlargement that can be seen or felt through the skin It is the most painful and most damaging to the usefulness of the horse of all the bone unsoundnesses. If a horse is lame in a rear

leg from no apparent cause, examine it carefully for the presence of the slightest abnormal development on the inside of the hock If spavin is developing, some minor enlargement can usually be detected In advanced stages the spavin ossification sometimes continues until the hard tumorous growth is clearly visible over the inside of the hock joint It may become as large as a man's fist Spavined horses should not be used as breeding stock

All the bone unsoundnesses of horses mentioned are at times treated by veterinarians by surgery or with the veterinarian's "firing iron," in an effort permanently to destroy the nerves in the area and relieve the animal from the continual pain Such operations are not always successful They should be attempted only by a highly skilled veterinarian

Curb, Thoroughpin, and Bog Spavin These are minor abnormal conditions which usually do not render a horse lame or interfere with his usefulness However, they indicate weaknesses in the structure of the leg, horses affected with them should not be used for breeding stock

The curb appears as an enlargement of the tendon that passes over the cap of the hock and down the rear of the leg It is observed just below the hock joint as the hock is viewed from the side Curbs may develop on strong sound hocks as a result of frequent heavy pulling or frequent running by race horses They do little damage but are unsightly and indicate weakness in the structure of the hock joint

The thoroughpin appears as a large, soft swelling in the upper portion of the hock It does little damage but is unsightly

The bog spavin appears as a large, soft swelling in front of the hock It does little damage but is unsightly Thoroughpin and bog spavin are caused by leakage of the joint fluid and its accumulation beneath the skin

Controlling Unsoundness The unsoundnesses of horses and mules as discussed and many others that occur less frequently and have not been mentioned are known to result largely from inherited weaknesses which make it likely that they will develop In striving toward the production of a higher percentage of horses and mules that will remain sound throughout their lives, it is essential that in so far as possible only sound stallions, jacks, and mares be used as breeding stock The horse or mule raiser should select breeding stock toward this end

Many states in which horse and mule breeding is an important enterprise have passed laws requiring the inspection and enrollment of

stallions and jacks before their owners are allowed to offer them for public service The principal requirement of such laws is that the stallion or jack be sound and that his breeding be stated In some states, only stallions registered as purebred of some recognized pure breed are allowed to be used for public service State stallion and jack enrollment laws have contributed to the reduction of some of the common unsoundnesses of horses and mules and, no doubt, have contributed thereby to the general improvement of the horse and mule stock of the country

SUPPLEMENTARY ACTIVITIES

1 With others in your class make a survey of the livestock losses by death and the probable causes of these losses on the home farms or ranches What percentage of the animals born in each herd of livestock was lost? What were the chief causes of losses? At what ages did the losses occur? What could be done to prevent them?

2 In connection with the above, make a survey of unthriftiness in animals What percentage of each kind of animals on your farms or ranches is unthrifty? What are some of the causes of this unthriftiness? What could be done to prevent these conditions?

3 With the other members in your local chapter of Future Farmers of America (F F A) or N F A , start a community campaign for the control of horse bots Secure the services of a local veterinarian and solicit the cooperation of farmers in having their horses treated with the least amount of travel by the veterinarian

4 With others in your class make a survey of sheep raised in your community, and determine the facilities for dipping If sufficient cooperation is ensured consider the possibility of constructing and operating a portable dipping outfit by your local F F A or N F A chapter Develop plans for the effective use of this equipment

5 Learn to perform such skills as the following and carry them out on the livestock you own or on the livestock on your home farm or ranch as needed

a Treat pigs for worms

b Treat pigs for mange

c Treat pigs for lice

d Apply measures for prevention of anemia in pigs

e Apply measures for preventing goiter in pigs calves or lambs

f Take milk samples by approved methods and have them tested for presence of mastitis

g Treat herds of cattle for ox warbles

h. Treat cattle for lice.

i. Treat calves for ringworm.

j. Dip sheep for stomach worms.

k. Drench sheep for stomach worms.

l. Treat lambs with sore eyes.

m. Treat horses for lice.

6. With others in your class, learn to detect unsoundnesses in horses by carefully inspecting several horses with various unsoundnesses, under the direction of your teacher.

7. Whenever possible, arrange with others in your class to observe a veterinarian at work diagnosing the causes of livestock losses and treating horses for bots, vaccinating, or applying various treatments to ailing animals.

8. Plan a swine sanitation system for the hogs in your project or for the herd of hogs on your home farm With the cooperation of your father, carry out the program of sanitation as planned.

9. For some one livestock enterprise on your home farm or ranch, find out the causes of losses by death, injury, and unthriftiness, and plan a program of prevention. With your father and the necessary assistance of a veterinarian, put the program into practice.

10 Construct a medicine cabinet for the livestock on your farm. Stock it with the necessary supplies for treating various ailments of livestock that lend themselves to home treatment, and place in a convenient location.

7. Breeding and Improving Livestock

ONE OF the best measures of a good livestock raiser is his ability to improve his herds and flocks. Even with rather mediocre animals, marked improvements can be made over a period of years if the right methods are used. In Chap. 2, emphasis is placed on selecting promising individual animals with which to make a start. Alert livestock breeders are especially interested in methods that make it possible to locate in their herds and flocks, from time to time, individual animals that produce well, breed regularly, and transmit desired characteristics to their offspring. Special attention in this chapter is given to improving herds and flocks through breeding. This is done under the following activities:

1. Planning a Program of Breeding and Improvement
2. Breeding and Improving Hogs
3. Breeding and Improving Dairy Cattle
4. Breeding and Improving Beef Cattle
5. Breeding and Improving Sheep
6. Breeding and Improving Goats
7. Breeding and Improving Horses and Mules

1. Planning a Program of Breeding and Improvement

In a study of a group of Illinois farms over a period of years by the college of agriculture in that state, it was found that the high income farms kept more and better livestock. Keeping high producing animals was of greater importance than just keeping large numbers of animals[1] (see Fig. 195).

Within limits, the higher the production of a herd or flock, the higher the profits. For dairy cattle, the figures in Table 10 indicate the importance of high production in securing a high return over feed costs. These figures show, for example, that in 1949 a cow which

[1] It Still Pays to Farm Well. *Circular* 458. College of Agriculture, Urbana, Ill. 1936.

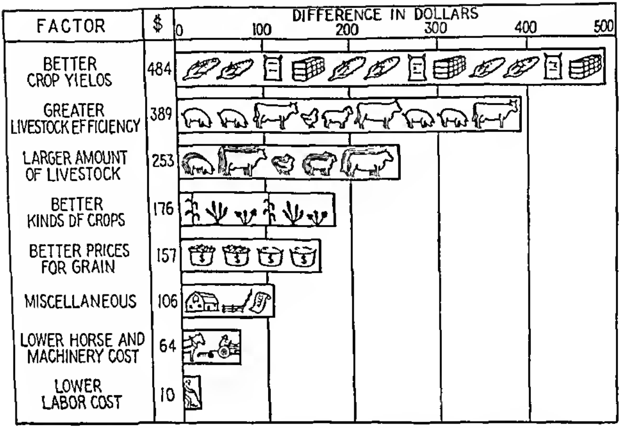

FIG 195 High livestock efficiency as shown by high producing animals is important for success in farming Through greater livestock efficiency, 19 Illinois farmers averaged $389 more income per year over 19 low income farms (*Circular 458, Illinois College of Agriculture*)

produced 200 lb of butterfat returned only $100 above feed costs, whereas a 400-lb producer returned nearly three times as much

Feed costs for high-producing cows are somewhat greater than for low-producing cows, as shown by the figures in Table 10 However, increased production and the resulting increased value of products sold per cow more than offset this increase in feed costs

TABLE 10 INCREASES IN RETURNS ABOVE FEED COSTS IN RELATION TO INCREASES IN PRODUCTION—1949*

Butterfat, pounds	Milk, pounds	Value of product, dollars	Feed cost, dollars	Returns above feed costs dollars
600	14,321	613	182	431
500	12,591	530	170	360
400	10,122	424	153	271
300	7,609	318	134	184
200	5,002	215	115	100
100	2,781	117	93	24

* Department of Dairy Science University of Illinois 1950

Such figures as the preceding ones indicate the importance of building dairy herds toward higher levels of production. Similar figures for other kinds of livestock show the advantages of high-producing animals. For example, the hog raiser who weans a reasonably large number of pigs per litter can produce pigs at a much lower cost than if the litters were small. In Table 11, data are summarized for 147 litters that were raised at the Alabama Experiment Station[2] The sows included raised two litters per year, were fed good rations, and were provided with pasture. This table shows that the feed required per pig raised

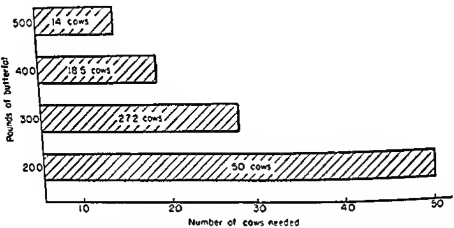

FIG 196 Taking figures for 1949 from Dairy Herd Improvement Associations in Illinois, to make $5,000 over feed costs required only 14 cows averaging 500 lb of butterfat, while 50 cows averaging 200 lb were required. The average production per cow in these associations was 363 lb of butterfat. (*Department of Dairy Science, University of Illinois.*)

in litters of two pigs was about four times that required per pig in nine pig litters. If labor costs were added, the advantages of the larger litters would be even greater, since the labor cost up to weaning would be about the same per litter regardless of the number of pigs in the litter.

It should be emphasized that increased production of the kinds shown in the previous examples is the result of a combination of factors or practices. However, effective methods of breeding and the improvement from the standpoint of the inherited ability of animals to produce are among the most important of these factors.

[2] Some Factors Affecting the Cost of Raising Pigs to Weaning Age, *Experiment Station Circular* 68. Agricultural Experiment Station, Auburn, Ala.

TABLE 11. EFFECTS OF SIZE OF LITTER ON FEED REQUIREMENTS AND FEED COST PER PIG AT WEANING AGE

No. of pigs weaned per litter	Av. weight, lb., per litter at weaning	Av. lb. feed required per pig weaned
2	63.0	448
3	95.4	291
4	139.2	226
5	144.5	190
6	188.4	153
7	189.0	136
8	219 2	119
9	238.5	110

Some livestock breeders maintain fairly high averages in their herds and flocks by culling out large numbers of inferior animals. For example, in D.H.I.A.'s in Michigan, as an average during 6 years, nearly one-fourth of all cows on which individual records were kept were taken from the herds each year. About 40 per cent of the cows removed were

FIG. 197. Lifetime production is an important measure of efficiency in dairy cows. This cow has a lifetime record or 230,723 lb. of milk and 7,350 lb. of butterfat. (*Holstein Friesian Association.*)

taken out of the herds because of low production[3] While low producing cows should be eliminated from dairy herds when they are found, the best dairy cattle breeders are finding it desirable to use methods of improving the level of inheritance in their herds so that fewer inferior producers are born The importance of this is obvious when it is considered that in many dairy herds two or three heifers are raised to every one that becomes a profitable producer

Since it is possible only after the first lactation period (and by this time the heifer is usually past three years of age) to determine whether or not she is an efficient producer, the costliness of developing herd replacements under these conditions becomes serious At recent feed prices, it cost around $130 to raise each heifer to producing age These costs are as great for a heifer that turns out to be a poor producer as for one that is a good producer When the matter is analyzed in this manner, it is evident that dairy herds need be improved so that a larger proportion of the heifers turn out to be good producers than is commonly the case

The situation with other kinds of livestock is similar to that in dairying as discussed later in this chapter Thus, one of the important problems in livestock production is that of breeding animals which are efficient producers

In Chap 2, some of the approaches to selection of individual animals were discussed, including type or appearance pedigree performance, and prepotency, or transmitting ability In improving herds, more attention must be given to the last factor that is, to the selection of individual animals which consistently transmit good qualities to their offspring This approach to selection is given primary consideration in this chapter

Measuring Efficiency of Livestock Before a livestock breeder can proceed intelligently in the improvement of his herds and flocks, he must decide in what respects he will seek to improve them Ordinarily, he is interested in improved production per animal in terms of butterfat, milk, wool, meat etc , depending on the kind of livestock Not only is he concerned with animals that are themselves good producers, he also wishes to secure animals for the breeding herd that consistently transmit high producing tendencies to their offspring

[3] A C BALTZER Causes for Cow Removals in Michigan Herds under Test in Dairy Herd Improvement Associations *Quarterly Bulletin* Agricultural Experiment Station Michigan State College East Lansing Mich vol 22 No 3 (February 1940) pp 147 153

In determining the productivity of farm animals and their offspring, a breeder must use appropriate measures of efficiency. These measures of efficiency are indications of the profit to be secured from various kinds of livestock. Some of the measures most appropriate for each kind of livestock are as follows:

Hogs. Number of pigs farrowed per litter; number of pigs per litter raised to weaning age; weight of litter at 56 days; weight per litter at some later age; weight per pig at some age after weaning, such as sixteen weeks or twenty-four weeks; days to reach market weight (such as 225 lb.); feed per 100 lb. or per pound of gain; proportion of animals in high market grades.

Dairy Cattle. Pounds of butterfat per cow annually; calving percentage (breeding efficiency, or reproductive rate, based on live calves per year from cows of reproductive age); cumulative production on a "lifetime" basis for individual cows.

Beef Cattle. Calving percentage in breeding herd; weight of calf at stated ages, such as six months and one year; average gain per day during fattening period; pounds of feed per 100 lb. or per pound of gain; proportion of animals in high market grades.

Sheep. Pounds of lamb per ewe (usually when lambs are 135 days old); pounds of wool per ewe; pounds of lamb credit per 100 lb. of ewe; lambing percentage, usually computed on basis of lambs raised to weaning time; proportion of wool in high market grades; proportion of lambs in high market grades (see also section on sheep in this chapter, page 373).

Horses. There is no satisfactory mathematical measure of efficiency of draft horses, except the dynamometer, to determine the maximum pull that can be exerted by a horse or team in starting a load and keeping it moving over a short distance.

Breeders of livestock must keep appropriate records for recording the information needed for measuring efficiency, as discussed in this chapter and also in Chap. 8. Every young man who enters the livestock business will find it highly desirable to keep records that measure the efficiency of the animals he raises in order to improve his herd or flock and sell breeding animals to advantage.

Setting Goals in Livestock Improvement. Some livestock breeders find it challenging to consider to what levels they will strive to improve their herds and flocks in a given period of time. In other words, they set goals that they will strive to attain through a long-time program of livestock improvement. Before formulating these goals, the breeder

decides what he wishes to improve, as discussed in the preceding paragraphs. He estimates the present level of efficiency of his livestock and compares this with production obtained by the better breeders of livestock. Then he sets a goal for the next year and for a fairly long period of time. In attaining these goals, he must use practices necessary for bringing about the desired increase in production. He must also use types of records that make it possible for him to measure his progress or lack of progress toward these goals, as discussed under each kind of livestock in this chapter and in Chap. 8.

As an example of setting goals of herd efficiency, a young man in Minnesota, when a sophomore in high school and a student in voca-

FIG 198 A litter of 10 pigs which weighed 590 lb at 56 days They were raised by a teen-age boy of Marshalltown, Iowa (*Hampshire Swine Registry Association*)

tional agriculture, worked out a long-time program of improvement for certain enterprises on the home farm[4] For a long-time goal, he set 400 lb of butterfat for the production of the average cow in the dairy herd, which at that time averaged 284 lb. Ten years later the herd averaged 315 lb. of butterfat, with many first-calf heifers and young cows in the herd Originally, the average pork marketed per litter was only 1,050 lb., and the average litter size was six pigs averaging about 175 lb. per pig at six months. The long-time goal was 1,800 lb. of pork per litter, and a check-up shows that this has been equalled or exceeded in recent years. Over a period of years, these and other goals which this young man set for his herds and flocks have

[4] H M HAMLIN, Is Long-time Farm Practice Planning Practical? *Agricultural Education Magazine*, vol 15, No 11 (May, 1943), p 208

been a challenge to him in building a program of livestock improvement, even though some of the goals were not reached as soon as expected.

A boy in vocational agriculture in Michigan, in cooperation with his father, developed an improvement project in dairying with the home dairy herd. Goals were set in successive years. Through keeping production records for every cow and using them for herd improvement, together with improved feeding, disease control, and other practices, the production levels were raised from year to year. The goal set and the actual production for each of 5 years are shown in Table 12.

The goal for each year was set in advance and served to create increased interest in using the practices needed to reach the goal.

TABLE 12. RECORD OF PRODUCTION LEVELS FOR 5 YR.

Year	Goal set, pounds (av. prod. per cow)	Actual production, pounds (av. prod per cow)
1	325	351
2	365	381
3	390	394
4	400	396
5	410	413

In forming a picture of what can be accomplished in livestock improvement, it is of value to become familiar with some examples of extremely high production for individual animals. In hog production, a litter of 12 pigs made a record weight of 670 lb. at 56 days (see Fig. 207). One litter of 17 pigs weighed 5,117 lb. at 180 days. One cow produced 1,614 lb. of butterfat in one year, and another produced 42,805 lh. of milk in one year. In "lifetime" production, one cow produced 8,509.8 lb. of butterfat in 10 lactations, and another produced 247,239 lb. of milk in 8 lactations. One herd of dairy cows on twice-a-day milking, at an average age of a little over four years, averaged 615 lb. of butterfat in one year. During a 12-month period, a sheep produced 52 lh. of wool and a ram averaged 31.5 lb. of wool per year over a 7-year period. A team of horses weighing 3,940 lb. made a tractive pull of 4,100 lb., which is equivalent to starting a load of 54,800 lb. on a wagon on a granite-block pavement or to pulling ten 14-in. plows in ordinary stubble at a depth of 5 to 6 in.

These records are all the more astounding when they are compared

with averages for the ordinary run of farm animals. For example, the average number of pigs raised per litter is around six, with an average litter weight of about 170 lb. at 56 days of age. The average dairy cow produces annually about 5,000 lb. of milk and 200 lb. of butterfat. The calving efficiency in the average beef or dairy herd is about 75 to 80 per cent, which means that each 100 cows instead of producing 100 calves per year are producing only 75 or 80 calves.

The extremely high records previously given are, of course, rare exceptions and have been made by animals of high capabilities under

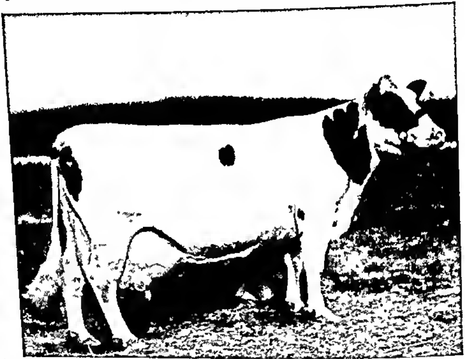

Fig 199 A champion butterfat producer, Carnation Ormsby Butter King, with a year's record of 1,402 lb of butterfat and 38,606 6 lb of milk. (*Holstein Friesian Association*)

conditions that were nearly ideal. Few breeders can hope to raise animals that will equal or better such records as these. On the other hand, the average production of farm animals is exceedingly low, and every breeder should strive to exceed it.

Using Scientific Methods of Animal Breeding. Nature was the first improver of animals; she was responsible for gradual changes that took place over a long period of time before men started taking a hand. In general, nature's methods were severe and ruthless. Animals in the wild state reproduced fairly regularly, but they were subjected to great

hardships in the form of severe climate and feed shortages, and frequently there were other kinds of animals that preyed upon them. As a result, in general, only those survived which were especially rugged, exceedingly cunning, fast runners, good fighters, or in other ways fitted to withstand hardships and combat their enemies. This process of natural selection is sometimes called the "survival of the fittest" because those in each generation best fitted to withstand hardships are most likely to survive and become the parent stock for succeeding generations.

Beginning of Animal Improvement. Man started as an improver of certain kinds of animals that had been through thousands of years of natural selection. In the process of domesticating animals, he began to select those which were least timid and in other ways served his purposes best. No doubt, rather early in working with animals, man noted that some of the desired characteristics of type or form tended to be transmitted by the parents to their offspring. As a result, he made a crude start in bringing about improvements in animals over and above those for which nature was responsible. It is known, for example, that the Arabians started to improve horses several thousands of years ago. These horses, used for riding purposes in war and peace, were improved along the lines of courage, endurance, speed, and beauty of form. This resulted in the breed now known as Arabians. Most of our present-day breeds of livestock, however, have been developed in recent centuries—some within the past 100 years.

Certain interesting and characteristic traits handed down from their wild ancestors are still noticeable in present-day farm animals. For example, sheep in tending to stay together show the "flocking instinct"; they are thus said to be *gregarious*. Animals show a desire to defend their young in various ways. Most breeds of cattle normally have horns. Horses are fairly fast on their feet and kick at strange objects. All these characteristics and others that might be named were important to survival among animals in the wild state.

In general, man has sought to improve animals along certain lines that would benefit him. The wool from the wild ancestors of our present-day sheep was coarse and hairlike. Man was responsible for bringing about improvements in its quantity and quality. Cows produced barely enough milk to give their young a fair start in life. Through breeding and selection by man, the present-day cow produces many times the amount of milk produced by her wild ancestors. Through selection, the size and strength of horses have been increased,

thus making them more suitable for pulling heavy loads. Animals used for meat have been improved from the standpoint of providing carcasses that are more suitable for this purpose. As an example of improvements in beef cattle, one has only to compare the Texas longhorn with a modern beef animal, as shown in Fig. 200.

How Inheritance Operates. While, as previously discussed, man has brought about many improvements in farm animals during the thousands of years that have passed since he domesticated them, it has been only in recent years that some of the principles of inheritance

FIG 200 Progress in improvement by breeding is illustrated by comparing the Texas longhorn steer of over 60 years ago with a modern Texas steer (*Bureau of Animal Industry, U S Department of Agriculture*)

have been discovered Today, the stockman is in a position to proceed more intelligently with animal improvement than ever before.

The job of transmitting qualities from one generation to the next is performed by two germ cells, one called the *sperm*, which is furnished by the male, and one called the *egg* or *ovum*, which is provided by the female. Each farm animal is the result of the union of two such tiny cells, one from each parent. This union of cells normally takes place following the act of mating. The two cells from which an individual offspring develops contain the materials that determine the inherited characteristics of that animal Thus, each parent provides a part of the

hereditary influence. Such characteristics as color of hair, capacity to produce milk, prolificacy, shape of body, and various others are determined at the time *fertilization* takes place, that is, at the time the sperm and the ovum join.

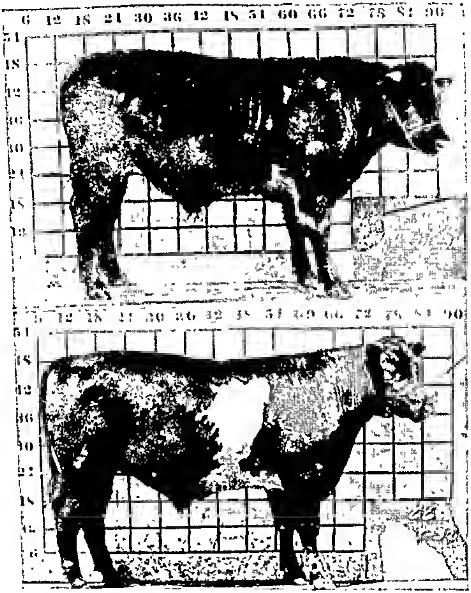

FIG. 201. Like does not always produce like. These two steers had the same parents and the same weight at birth. The steer shown below reached 900 lb. in 91 days less time than the one shown above and produced 25 per cent more beef for each 100 lb. of digestible nutrients eaten. (*U.S. Department of Agriculture.*)

The materials in the germ cells that are responsible for the later development of certain characteristics in the offspring are called the *bearers* or *carriers* of heredity. Before the cells unite, certain changes take place during the formation of the sperm cells and eggs that make it possible for the carriers of heredity to come together in various combinations, depending on which sperm happens to combine with which ovum or egg.

Combinations may occur that result in certain characteristics in the offspring similar to those of the parents, but it is also possible for combinations to occur that result in offspring different in certain respects from their parents and from each other. Thus, a person has certain characteristics like those of his parents and certain others unlike those of either parent. For example, a person may or may not have the same eye color as his parents. It is possible that he may have blue eyes even though his parents were brown eyed. The blue eyes, however, are the result of bearers of heredity that were transmitted from the mother through the ovum and from the father through the sperm.

In the case of each breed of livestock, certain characteristics are transmitted with a high degree of uniformity from parents to offspring. For example, purebred Holstein parents usually have black-and white offspring. In rare instances, however, certain Holsteins, even though both parents are black and white and are purebred, may bear red and white offspring. For certain characteristics, such as capacity to produce milk, it is possible for offspring to differ markedly from each other and from the mother, depending on whether the bearers for high or for low production (or a combination of both) were shuffled into the particular germ cells that combined to form the individual animal. When certain parents have several offspring most or all of which are high producers, they are said to be *prepotent* for high production, which means that most or all of the germ cells are the type which carry tendencies for high production.

Summary of Principles of Inheritance. From the preceding discussion, it should be possible to understand the following principles, which are basic to the science of animal breeding.

1. The individual animal is made up of characteristics that are inherited from its sire and dam.
2. These characteristics are inherited through one cell (the egg) from the dam and one cell (the sperm) from the sire, which combine following the mating process.
3. Offspring may differ markedly from each other and from one or both parents, owing to the "shuffling" of the chromosomes or carriers of heredity, that took place in the formation of the germ cells prior to the time they combined.
4. On the other hand one or both parents may transmit desired characteristics very uniformly to their offspring owing to the chromosomes being relatively pure for these characteristics.

Selecting Animals That Transmit Desired Characteristics. The basis of success in improving farm animals lies in selecting good individuals that transmit their good qualities consistently to their offspring. As discussed in Chap. 2, a pedigree at best indicates only what an animal probably will be, and appearance or type indicates primarily the degree to which it is outwardly pleasing to the eye. None of these is an accurate indication of an animal's ability to produce, and they are of

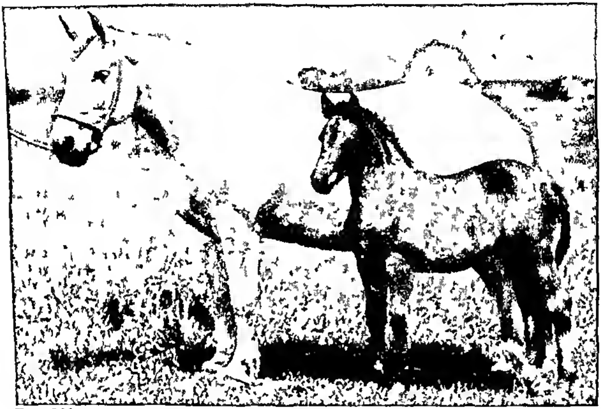

FIG 202 Coreen, a fine old Percheron mare, transmitted her good qualities to her offspring She is shown here at the age of twenty one years with her seventeenth foal Later she produced two more colts Many of her offspring have been champions and in turn have produced excellent colts, thus showing the prepotency of this brood mare in transmitting desirable qualities (*Michigan State College, photograph by Cook and Gormley*)

even less value in indicating an animal's value as a breeder. Only by checking on the progeny can we determine the true breeding worth of an animal. The offspring show what kind of inheritance an animal really has and will transmit. This use of the offspring to determine the ability of a male or female to transmit desirable characteristics is called the "progeny test." The use of the progeny test is one of the most effective methods for bringing about improvements in livestock.

Since most livestock breeders depend on sires for major improvements in their herds and flocks, selecting males that transmit desired character-

istics is a very important task. It becomes especially difficult to secure a satisfactory sire for improving a herd that already produces on a fairly high level. This is illustrated by some figures from the U.S. Department of Agriculture, Bureau of Dairy Industry, as shown in Table 27, page 361. Based on these figures, if a sire is picked as the average D.H.I.A. member does it, the odds of getting a sire that will improve production are 3 to 1 if the dams give less than 250 lb. of butterfat, but only 1 to 7 if they produce over 500 lb. Most of the dairymen represented probably used considerable care in selecting the sires used. No doubt, they also placed considerable confidence in type and pedigree at the time of selecting the bulls. However, the results show that more satisfactory methods for selecting sires are needed. In later portions of this chapter, such methods are discussed further for each kind of livestock.

Using a System of Breeding Suitable for a Herd or Flock. In general, there are three kinds of livestock breeders, classified from the standpoint of the use made of the surplus animals that are produced in their herds and flocks.

1. *Breeders who produce animals to supply the needs of the open market and such items as milk and wool.* This group includes the vast majority of all livestock raisers. The better breeders have grades, crossbreds, or unregistered purebreds for the female stock, and these are mated to purebred sires. Many of these breeders still keep nondescript females and use inferior sires of questionable breeding.
2. *Breeders who supply the above group with purebred sires and some purebred females.* Some surplus animals and products are also sold on the open market by this group.
3. *Master breeders who produce "top notch" animals for other master breeders and for the second group just mentioned.* Products such as milk and wool from these animals are sold on the open market, although this usually represents a minor part of the income.

Various systems of breeding are used by livestock breeders. Those producing animals for the open market who use purebred sires and thereby gradually build up herds of high grade females practice what is known as "grading up." Some of them use "crossbreeding." In the case of the other two groups of breeders, who use purebreds exclusively, some "inbreeding" and "line breeding" may be done, as well as "outcrossing." These systems are briefly explained in the paragraphs that follow.

Grading Up. Many of the breeders of livestock who produce animals and goods such as milk, butterfat, and wool for the open market do not maintain purebred herds, and many of them still have scrub females that are mated to inferior males. For most of these breeders, the road to improvement lies in the use of good, purebred sires on the "common" females already owned. Through careful selection of females in each succeeding generation and the continued use of purebred sires from the same breed, it is possible to build up a herd of high grades. The value of this process of grading up in swine is shown in an experiment at the Alabama Experiment Station Starting with scrub pigs, purebred sires were used for three generations. This resulted in marked improvement in type and quality, as well as in the rate of gains and the feed required for 100 lb. of gain.[5] Further details are shown in Table 13.

TABLE 13. RESULTS OF GRADING UP HOGS THROUGH THE USE OF PUREBRED SIRES

	Wt per pig at 56 days of age, lb	Av daily gains, lb	Days to reach 200 lb	Feed, lb per 100 lb of gain
Scrub pigs.....	22 2	0.95	243 7	465 4
50 per cent purebred (1st cross)	28 6	1 18	201.3	403 4
75 per cent purebred (2d cross)	28 4	1 19	201 0	387 6
87 5 per cent purebred (3d cross) .	35 4	1 26	187 0	381 5

These figures and others in later portions of this chapter show that improvements are especially rapid in the first two or three generations of grading. From that point on, increased care in the selection of sires and female stock will be necessary for continued improvement, as indicated for each kind of livestock in other portions of this chapter.

Crossbreeding. The mating of a sire of one breed to females of another breed is called "crossbreeding." To date, crossbreeding has been carried on most extensively with swine, although many sheep ranchers, some owners of farm flocks of sheep, and some raisers of beef cattle are using this system of breeding. In most cases where it is used, the breeder is producing market stock.

Extensive experiments in crossbreeding hogs have been carried out at the Minnesota Experiment Station. These results prove con-

[5] Grading Up Hogs by the Use of Purebred Sires, *Bulletin* 231, Agricultural Experiment Station, Auburn, Ala., 1930

vincingly that the crossing of breeds usually results in increased vigor, faster growth, and more efficient use of feeds It has also been shown that a crossbred sow is highly satisfactory as a brood sow if mated to a purebred boar of either of the parent breeds or to a purebred boar of a third breed These crossbred sows produced litters with more pigs per sow at weaning time, and each pig weighed 5 to 7 lb more than purebred pigs The crossbred pigs reached a weight of 225 lb 17 to 22 days earlier than comparable purebreds and required less feed to do so[6] The increased vigor, or "kick," that usually results from crossbreeding is called "hybrid vigor"

Inbreeding Breeders of purebreds occasionally use inbreeding or line breeding Inbreeding consists in mating closely related individuals, such as father and daughter, mother and son, and sister and brother The aim is to "fix" desirable characteristics, that is, to develop strains of animals which are more prepotent for certain desired characteristics While it has commonly been supposed that inbreeding will lead to decreased vigor, some experiments have shown that this is not necessarily the case if careful selection is made of the most vigorous animals Inbreeding should be used with caution and usually only by breeders who have developed their herds to quite high levels of efficiency It is a tool for fixing qualities already possessed by the foundation animals, and while it will bring about increased uniformity it will not raise the level of production above that already existing in the herd or flock Remember, undesirable qualities may be fixed as well as desirable ones In some cases inbred lines within the same breed are crossed, with favorable results, as discussed in connection with swine

Line breeding is the mating of related animals no closer than cousins Like inbreeding, the object is to fix desired characteristics so that they will be transmitted more uniformly As with inbreeding, it is generally used, if at all, in herds and flocks that have been raised to high levels of production

Outcrossing is the mating of animals of the same breed but of strains unrelated for at least four or five generations This method is most commonly used by the rank and file of purebred breeders, as they usually procure sires unrelated to the female stock Although the offspring may vary widely in form or production, they are usually vigor-

[6] Crossbred Swine *Special Bulletin* 180 Agricultural Extension Division University Farm St. Paul Minn 1936

ous. Proved sires or sons of proved sires are most desirable in any case, as discussed further for each kind of livestock.

Controlling the Reproduction of Farm Animals. When animals become sufficiently mature to be capable of reproduction, they are said to have reached sexual maturity. Females of most kinds of livestock show indications of having reached the stage when they have their first "heat," or *oestrous,* period. Usually, it is not desirable to breed the female at the time of the first heat period because her physical development is insufficient to stand the strain of pregnancy and to produce milk following the birth of the young. However, well-developed females can be bred at a fairly young age, as discussed later.

In farm animals, the heat period occurs at definite and regular intervals until the female is bred and becomes pregnant. In the case of ewes, with the exception of the Dorset Horn breed, the heat periods usually occur only during the months of late summer, fall, and early winter. Most other farm animals come in heat throughout the year, except during pregnancy.

After breeding, if a female becomes pregnant, the early development of the young takes place within her body in the organ known as the *uterus.* This period, which differs in length for each kind of livestock, as shown in Table 14, is known as the *gestation* period, and the act of giving birth is called *parturition.* While in the uterus, the developing young, called the *fetus,* receives its nourishment from the mother. This is made possible by a special membrane known as the *placenta,* which develops early in pregnancy and is attached to the walls of the uterus. Nutritive materials from the blood stream of the mother are received by the blood vessels in the placenta. These converge into the large blood vessels which reach the fetus through the navel cord. Certain waste materials from the fetus are carried to the placenta, where they are absorbed by the blood stream of the mother. Actually, the blood stream of the mother does not join directly with the blood vessels in the placenta. Rather, the two blood streams are separated by the thin walls of tiny blood vessels in certain portions of the walls of the uterus and the placenta.

In the case of the male, it is desirable to restrict carefully the number of services when he is young. The information in Table 14 is provided as a guide in breeding different kinds of farm animals.

Brood sows can be bred for two litters per year. For all other kinds of livestock, it is usually desirable to have the females bear young once a year.

TABLE 14 INFORMATION USEFUL IN BREEDING DIFFERENT KINDS OF FARM ANIMALS

	Swine	Cattle	Sheep	Horses
Age to breed females (if well grown)	8–9 months	15–18 months	18–19 months*	2–3 years
Frequency of heat periods	18–21 days	18–21 days	16–19 days	18–21 days
Lengths of heat periods	1–3 days	1 day or less	1–2 days	2–7 days
Length of gestation period	112–114 days	281–283 days	145–150 days	336–340 days
First heat period after parturition	3 days†	3–4 weeks‡	Next fall	7–10 days
Age for first use of male	8 months	12–15 months	7 months	2 years
Number of services for young male	15–20 sows	10–20 cows	15–25 ewes	10–30 mares
Number of services for mature male	40–60 sows	40–60 cows§	40–50 ewes	100–125 mares

* Some ewe lambs come in heat at about seven months of age and may be bred

† Also within 3 to 5 days af er weaning p gs unless bred earlier

‡ Six and eight weeks if suckling calf

§ On range—about 25 to 40 cows

The use of a gestation table is helpful in determining the probable day of birth with a given date of service for a certain kind of livestock Table 15 is provided for this purpose For dates of service other than those shown, the dates of birth can be computed accordingly (For example, if a mare is bred on May 10, she will foal about Apr 15 the following year)

Prior to breeding, have the females in a thrifty condition Special feeding practices are recommended for use during a period of two to three weeks prior to breeding such animals as ewes and sows In the case of ewes, do this by providing a luxuriant pasture or by feeding ¼ to ½ lb of grain per ewe per day For sows, increase the grain ration during the period mentioned Such improvements in the ration prior to breeding are spoken of as "flushing" This practice seems to stimulate the release of more eggs, or ova, in the body of the female and thus may result in the formation of more offspring, especially if the female is below normal in condition at the beginning of the breeding season

Keep males in good breeding condition but not fat Provide exercise, together with proper amounts of feeds of various kinds, in order to keep an animal a reliable breeder Breeding difficulties on the part of the male or females may seriously reduce the profits in a herd or flock owing to the reduced number of offspring

TABLE 15 GESTATION TABLE FOR FARM ANIMALS

Date of service	Probable date of birth of young			
	Sow (114 days)	Ewe (150 days)	Cow (283 days)	Mare (340 days)
Jan 1	Apr 25	May 31	Oct 11	Dec 7
Feb 1	May 26	July 1	Nov 11	Jan 7
Mar 1	June 23	July 29	Dec 9	Feb 4
Apr 1	July 24	Aug 29	Jan 8	Mar 7
May 1	Aug 23	Sept 28	Feb 8	Apr 6
June 1	Sept 23	Oct 29	Mar 11	May 7
July 1	Oct 23	Nov 28	Apr 10	June 6
Aug 1	Nov 23	Dec 29	May 11	July 7
Sept 1	Dec 24	Jan 29	June 11	Aug 7
Oct 1	Jan 23	Feb 28	July 11	Sept 6
Nov 1	Feb 23	Mar 31	Aug 11	Oct 7
Dec 1	Mar 25	Apr 30	Sept 10	Nov 6

In order to secure the maximum benefits from superior sires, artificial breeding is now being used, especially with dairy cattle This process, known as *artificial insemination,* makes it possible to secure more offspring from a given sire than by mating him in the usual way The *semen,* which is the material from the male reproductive organs containing the sperm cells, is collected periodically, divided, and placed artificially in the uterus of each of several females, thus bringing about several matings to each one possible under natural breeding methods Sires that have shown ability to transmit desired characteristics uniformly to their offspring are rare, but it is thus possible to multiply by several times the offspring that each would be capable of siring by natural mating methods As discussed further in connection with dairy cattle (page 362), this method holds promising possibilities, and extended use of it has been made in breeding dairy cattle

Organizing Group Activities in Livestock Breeding and Improvement. By working together in the purchase and use of breeding stock, several breeders can often progress much faster than would otherwise be possible Boys in certain departments of vocational agriculture have joined together to purchase boars that are used cooperatively, as shown in Fig 203

Adult farmers organize D H I A's in each of which about 26 herds of dairy cattle are entered A person is hired who visits each of the farms

Fig 203 A Duroc Jersey boar owned cooperatively by the Future Farmers o America chapter at Iowa Falls, Iowa The lower photograph shows 7 gilts fron a litter of 12 pigs which weighed 516 lb at 56 days as shown in Fig 204 Th boys cooperatively own a number of excellent sires Each year they hold auctio sales of production tested breeding stock (*C E Bundy, Iowa*)

one day each month to secure samples and weights of milk and to test th milk for butterfat for each cow in production He then computes fo the current month the production, the value of product, the amount an cost of feed, and the profit above feed costs for each cow. These recor are accumulated monthly over a year's time and are used in cullin low-producing cows, proving sires, and selecting brood cows. In man departments of vocational agriculture, the boys perform this service f

their home herds, and in some cases they find it desirable to organize "junior" D.H.I.A.'s (see production records in Chap. 8).

In these and other ways, cooperative effort is helpful in livestock breeding and improvement.

2. Breeding and Improving Hogs

Improving a Purebred Herd of Hogs. A breeder who raises purebred hogs to sell to other breeders has a great responsibility in providing animals that will improve the herds where these animals are to be used. The alert breeder of purebreds no longer depends on show-ring winnings or other indications in appearance or type as the sole measure of the value of the breeding animals that he uses in his herd or sells to other breeders. He develops methods for measuring the efficiency of his breeding stock in terms of size of litters farrowed, pigs raised per litter, suckling ability of sows, and ability of the pigs to gain rapidly and economically. In general, his profits increase as these characteristics are improved. Some of the possibilities for improving herds along these lines are revealed in experimental work with brood sows at the University of Missouri. Brood sows that had raised litters were divided into groups on the basis of pigs raised per litter and the weight of the litter at fifty-six days.[7] The following classes were made of these sows:

Excellent. Sows that produced at least eight pigs that weighed not less than 400 lb. per litter at 56 days of age.
Superior. Sows that produced at least seven pigs that weighed not less than 325 lb. per litter at 56 days of age.
Good. Sows that produced at least six pigs that weighed not less than 250 lb. per litter at 56 days of age.
Medium. Sows that produced at least five pigs that weighed not less than 175 lb. per litter at 56 days of age.
Inferior. Sows that produced less than five pigs that weighed less than 175 lb. per litter at 56 days of age.

The data for three typical sows, one each of the good, medium, and inferior groups, are shown in Table 16.

From the figures shown, it is evident that the number of pigs raised and the weight of the litter at fifty-six days are good indications of the value of these sows as producers and of profits from their litters. For

[7] Some Factors Influencing Efficient Production of Sows, *Bulletin* 461, Agricultural Experiment Station, Columbia, Mo., 1943.

TABLE 16 THE RELATION OF WEIGHTS OF LITTERS AT 56 DAYS TO WEIGHTS AT 6 MONTHS AND TO FEED REQUIREMENTS FOR 100 LB OF HOG MARKETED

Classification of sow	No of pigs in litter	Wt, lb, at 56 days		Wt, lb, at 6 months		Feed, lb, per 100 lb of hog marketed*
		Litter	Av per pig	Litter	Av per pig	
Good produce	10	320	32	2,595	259	341
Medium producer	7	186	27	1,314	188	448
Inferior producer	4	116	29	666	167	571

* Includes amount of feed eaten by the sow from time of breeding and by sow and litter to time of weaning (56 days)

example, a sow that was a good producer (as shown by the fact that 10 pigs were raised to a weight of 320 lb at fifty-six days) made it possible to market 100 lb of live hog on 341 lb of feed An inferior producer, with a litter of 4 pigs raised to 116 lb at fifty-six days, increased the feed requirement to 571 lb per 100 lb of hog marketed The above data and other data collected in this experiment show that in large litters the average weight per pig at weaning (fifty six days) was usually as great as or greater than in small ones This is somewhat contrary to the common belief that small litters tend to offset the smaller numbers by faster growth of individual pigs

The figures in Table 16 show the desirability of breeders of purebred swine adopting some measures of efficiency for hog production, as emphasized earlier in this chapter These and other studies indicate that number and weight of pigs raised are the most precise measures of the productivity of sows Securing these figures when the pigs are 56 days of age, or at the usual weaning time, has been accepted as more or less standard practice by most breed associations in their sow-testing work However, more recent experiments show that weights of litters at a later age are somewhat more accurate as indicators of the influence of heredity [8] It seems likely, nevertheless, that the 56 day weights will continue to be used widely because of some of the practical advantages of weighings at this age and because several breed associations have set up sow testing programs based upon weights of litters at this age In addition to the 56 day weights, some breeders secure litter weights and weight per pig at

[8] HAZEL BAKER and REINMILLER The Relative Importance of Heredity and Environment in the Growth of Pigs of Different Ages *Journal of Animal Science*, vol 2 No 1 (February 1943)

around 150 days of age or older, since the best measure of a pig's ability to grow after weaning is the rate of gain it makes during a portion of the period after weaning. Litter size and litter weight at 56 days are about 18 per cent heritable, while the weight of the individual pig at 150 days of age is about 30 per cent heritable. This information is useful in improving swine, but it should be used along with information on near relatives and progeny tests when available.

In Michigan, the students in 12 departments of vocational agriculture cooperated in providing data for swine litters. In Table 17, data are

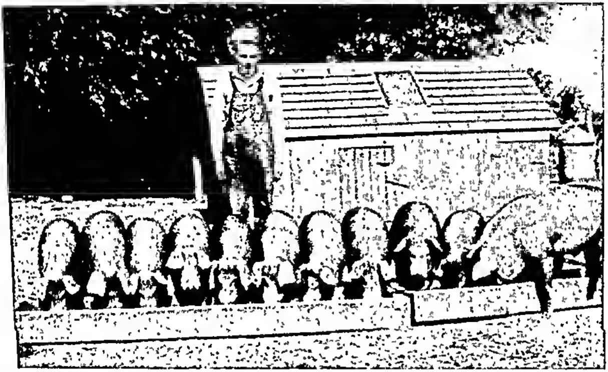

FIG. 204. High-quality offspring result from selecting good breeding stock and providing proper feeding and care. This Iowa boy in his first year of vocational agriculture at Iowa Falls, Iowa, raised this litter of 12 pigs, which weighed 516 lb. at 56 days. (*C. E. Bundy, Iowa.*)

shown in which 120 of these litters (mostly from first-litter gilts) are classified on the basis of litter weights at fifty-six days, as shown in the left-hand column. The figures in the last three columns show, in general, that in order to secure high litter weights at fifty-six days it is necessary (1) to have a fairly large number farrowed per litter, (2) to save a large proportion of the pigs farrowed, and (3) to obtain rapid growth in the pigs.

In Table 18, the litters have been classified by thirds (low, medium, and high) on the basis of (1) litter weight at fifty-six days, (2) weight

TABLE 17 COMPARISONS OF LITTER DATA ARRANGED IN GROUPINGS BY LITTER WEIGHTS AT 56 DAYS

120 Litters in 12 Departments of Vocational Agriculture in Michigan

Wt of litter at 56 days lb	No of litters in group	Per cent of litters in group	Av no of pigs farrowed	Av no of pigs raised to 56 days	Av wt, lb, per pig at 56 days
99 or less	5	4 2%	7 4	2 2	24 4
100 149	5	4 2	7 6	6 0	21 5
150–199	19	15 8	8 1	6 0	29 9
200–249	28	23 3	9 6	7 0	32 2
250–299	25	20 8	10 0	8 1	34 5
300–349	13	10 8	9 5	8 4	38 7
350–399	15	12 6	10 7	9 1	40 0
400 or more	10	8 3	12 2	10 3	44 0

per pig at fifty six days, (3) number of pigs farrowed per litter, and (4) number of pigs per litter raised to fifty-six days Averages for all litters are also shown This table is useful in at least two ways First, one can compare his litter or litters of pigs with the data in the table to determine for each of the items whether he is in the low third, middle third, or high third of swine producers taking vocational agriculture Second, one can use the data in setting goals for the future with respect to litter weight, weight per pig, etc Many other uses can be made of the data in these two tables that will stimulate persons to analyze their accomplishments and make plans for improving their efficiency as pork producers in successive years

Developing "Yardsticks" and Setting Goals From the preceding discussion, it seems important for hog breeders to concern themselves with increasing the litter sizes and growth rate of the litters in their breeding herds While these are influenced by feeding, care, and other environmental conditions, experiments have shown that heredity also is an important factor In checking on their results and setting goals for the future, you need some kind of yardstick, or standard From the data on previous pages, most persons would agree that gilts with their first litters would be doing only poorly to fair if they raised 5 to 7 pigs per litter with a litter weight of less than 200 lb at fifty six days of age Raising 8 to 9 pigs per litter to a weight of 200 to 300 lb is good Litters of 9 or more pigs raised to a weight of 300 lb or better include about one-third of the litters shown in Table 18, and these can be considered very good to excellent Mature sows should be expected to raise at least one more

TABLE 18 COMPARISONS OF LITTER DATA AT 56 DAYS GROUPED BY THIRDS (LOW, MIDDLE, AND HIGH) AND FOR ALL LITTERS COMBINED
(120 Litters in 12 Departments of Vocational Agriculture in Michigan)

Item*	Low third	Middle third	High third	All litters
Number of litters	40	40	40	120
Range in weight per litter at 56 days	31–222 lb	222–298 lb	298–540 lb	31–540 lb
Average weight per litter at 56 days	164 9 lb	258 7 lb	370 4 lb	264 7 lb
Range in weight per pig at 56 days	14 7–32 0 lb	32 0–38 0 lb	38 0–60 2 lb	14 7–60 2 lb
Average weight per pig at 56 days	26 3 lb	35 8 lb	43 9 lb	35 3 lb
Range in pigs farrowed per litter	3 8	8–11	11–15	3–15
Average pigs farrowed per litter	7 0	9 5	12 4	9 6
Range in pigs per litter raised to 56 days	1–7	7–9	9–13	1–13
Average pigs per litter raised to 56 days	5 2	7 8	9 8	7 5

* Each classification was made independently of the other For example the computations for litter weights were based on a ranking of litters in order of weight the computations for weight per pig were based on a ranking in order of average weight per pig in the litters etc

pig per litter than gilts, and the litters should weigh 40 to 50 lb more at fifty-six days of age

Selecting Sows and Gilts As has been emphasized in previous portions of this chapter and in Chap 2, selecting a sow on the basis of type and pedigree often proves disappointing More emphasis needs to be placed on the use of performance records as indicated by the number of pigs in her litter and the litter weight at fifty six days (or some other age) The tendency for high or low production along these lines is transmitted from parents to offspring, and it is important to select sows and gilts that are *prepotent* for these characteristics

Since, in general, sows that are poor producers as shown by one litter will be poor producers in future litters, such information is of value in deciding which sows to keep and which to cull out However, at times a litter may not develop favorably owing to poor care or some other cause for which the sow is not responsible, and in this case it may be desirable to give the sow another chance Litters from gilts will average fewer pigs of lighter weight than litters from older sows The exact level that will be expected of sows in order to be retained in the herd will depend

on the amount of improvement already brought about in the herd and the number of sows that are to be kept for future litters A breeder who has developed his herd to a high level or who wishes to keep only a small portion of the sows for additional litters will wish to cull rather severely

The hog breeder is also concerned with methods that will make it possible for him to select gilts most likely to be high producers Experimental work at the University of Missouri[a] provides some helpful information summarized in Table 19 The figures show that the sows which were good producers had a larger percentage of good producing

Fig 205 Robert Harvey eighteen year-old Iowa farm boy with the herd of gilts on his home farm where he has charge of hog raising His record for 1 year was 229 pigs farrowed and 194 raised from 24 sows (*Wallaces' Farmer and Iowa Homestead*)

daughters than the medium producing sows (40 6 per cent in the former and 17 4 per cent in the latter) In inferior producing sows 86 4 per cent of the daughters were inferior producers (see page 341 for explanation of "good," "medium," and "inferior")

Thus, it is shown that the productivity of the dam is important in determining which gilts to select Keep records on all litters in successive generations, it will then be possible to select gilts from blood lines that are most prepotent for the kinds of inheritance involved in raising large litters of fast growing pigs (See Fig 206)

The breeder of purebred hogs is interested in the extent to which desired type and breed characteristics are transmitted to their offspring by

[a] Some Factors Influencing Efficient Production of Sows *Bulletin* 461 Agricultural Experiment Station Columbia, Mo

TABLE 19. PRODUCTIVITY OF DAUGHTERS FROM GOOD-, MEDIUM-, AND INFERIOR-PRODUCING DAMS

Dams		Total daughters	Percentage of daughters in each class			
Class	No.		Superior	Good	Medium	Inferior
Good	26	69	1.5	40.6	29.0	29.0
Medium	22	46	0.0	17.4	52.2	30.4
Inferior	17	22	0.0	0.0	13.6	86.4

given sows. In some litters, the pigs may be uniformly good in these respects; in certain litters, some may be good and others poor; in other litters, all or nearly all may be poor. It is, of course, preferable to save gilts from litters that are uniformly good in type, for this indicates that

FIG. 206. As an outgrowth of adult farmer classes at Austin, Minn., the Austin Area Sow Testing Association was formed. As part of their improvement work, members obtain 56-day litter weights. *Left*, marking pigs for identification; *right*, weighing at 56 days, using bathroom scales. (*Successful Farming.*)

the inheritance, or "genetic make-up," is relatively "pure" for desired characteristics. In selecting gilts on the basis of type and breed characteristics, it is preferable to wait until they are at least three months old, as younger pigs may develop some undesirable defects if selected at an earlier age.

As has been mentioned, the breeder of purebred hogs frequently wishes

to keep certain brood sows for raising additional litters, especially if they have proved themselves to be good producers along the lines mentioned Keep records on additional litters in order to accumulate further evidence of a sow's worth as a breeding animal

A breeder of purebred hogs should become familiar with the methods and regulations for the official recognition of high producing sows in the breed Swine registry associations have recently adopted uniform rules for an 'All breed Production Registry" Detailed regulations are avail able from each registry association, but the basic requirements include the following

1 Litters to be nominated must be ear marked witnessed and reported to the breed association within 5 days after the farrowing date
2 All nominated litters must be weighed with witness present between 51 and 61 days of age and reported to breed association within three days after pigs are weighed Litter weights are then calculated to a uniform 56 day basis as shown on page 398
3 *Qualifying Litters* A litter qualifying for the Production Registry shall be as follows (1) for a sow (over 15 months of age at farrowing time) to raise eight or more pigs to an official 56 day litter weight of at least 320 lb (2) for a gilt (15 months of age or younger at far rowing time) to raise eight or more pigs to a 56 day litter weight of at least 275 lb
4 *Qualifying Sows* A sow will be officially admitted to the Production Registry after she has raised two qualifying litters
5 *Qualifying Boars* A boar will be admitted to the Production Registry of his breed in accordance with regulation indicated on page 349

There is already a nation wide interest in this sow testing program More and more buyers will be demanding information of this kind for the breeding stock they buy and these buyers will expect to pay a premium for production tested boars and gilts with creditable records

Selecting Boars A breeder of purebred hogs usually plans on pur chasing boars from other breeders who produce animals of merit, al though he occasionally selects boars within his own herd especially if he carries on line breeding or inbreeding The typical breeder of purebred hogs plans on getting boars unrelated or remotely related to the females and thus practices what was previously described as outcrossing'

An alert breeder pays attention to type and pedigree in selecting the boar but he is not satisfied with stopping at this point If possible secure a tried boar in which the offspring are of approved type and

are rapid growers as shown by weights at fifty-six days. While the boar has little or no influence on the number of pigs in the immediate litters that he sires, it is desirable to secure a boar from a large litter, as he will have some influence on the number of pigs in the litters farrowed by his daughters.

In the uniform rules recently adopted by swine registry associations for the "All-breed Production Registry," provision is made for qualifying boars. To be officially admitted to the Production Registry, a boar must be the sire of five Production Registry sows (not more than two of which are full sisters), or 15 sows (not more than 6 of which are full sisters) that have raised qualifying litters, or an "equivalent" combination of daughters from these two groups.

If possible, in procuring a young boar select one from a sow and a boar both of which have met the requirements for the Production Registry. Select a boar from a large litter of fast-growing pigs. For use in good herds, secure a boar from a litter of eight or more pigs weighing upward of 400 lb. at fifty-six days. By delaying the selection of the boar until the age of five to six months, it is possible to consider rate of growth after weaning. Furthermore, inspect the pigs in the litter, and note whether or not the litter mates are uniformly good in rate of growth and in the desired type and breed characteristics. If available, note whether or not both his sire and his dam are of desirable type and are large and vigorous.

Group Efforts in Swine Improvement. Some breeders find it desirable to carry on certain group activities that lead to swine improvement in the herds owned by them. For example, in certain departments of vocational agriculture, the students are sponsoring swine improvement associations as subsidiaries of local chapters of the F.F.A. by which superior females are procured as foundation stock and placed out on a "chain" or "return in kind" basis. Many of these organizations are buying boars cooperatively by sale of shares to persons who wish to breed sows. By this means, boars of superior merit are secured and used for breeding a large number of sows at a resulting low cost per sow.

At Iowa Falls, Iowa, the boys in the department of vocational agriculture in the high school and young farmers out of school have an organization known as the Iowa Falls Duroc Breeders Association, which has been in existence nearly 25 years. These young swine breeders purchase cooperatively several boars each year, check on their efficiency as breeders through litter weights at fifty-six days, and hold sales of boars

and gilts The animals placed on sale are from abortion free herds and are carefully selected in terms of size and weight of litters and general type Sale catalogues show information on litter weights for each animal sold, in addition to the usual information on pedigrees (See Fig 203)

At Austin, Minn , the Austin Area Sow Testing Association was formed several years ago among swine raisers in adult-farmer classes in swine

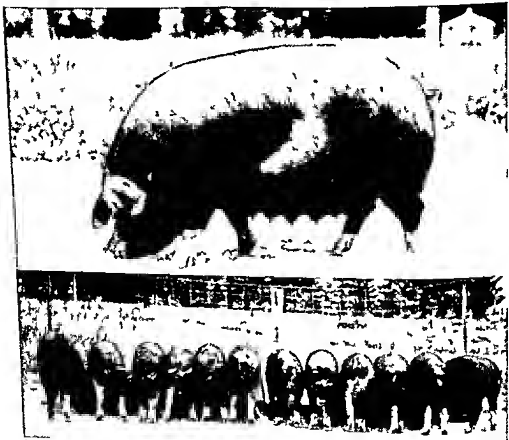

Fig 207 A sow and her litter showing the result of good breeding practices This sow and litter were produced by a member of the Austin Minn Area Sow Testing Association The 12 pigs weighed 670 lb when 56 days old (*Crane and Niehuis Minnesota*)

production carried on at the local high school The main emphasis has been placed on sow testing through litter weights at fifty six days These breeders also check cutout values when the hogs are slaughtered and study methods for improving their efficiency in swine production As shown in Fig 207, a recent litter raised by one of the members of this association made a weight at fifty six days of 670 lb , which is one of the

highest on record to date. There are six generations of production-tested sows behind the dam of the litter, and the sire was the top boar in a sale of tested boars.

Several colleges of agriculture are encouraging sow testing through their extension services. In Iowa, the Extension Service sponsors a swine-improvement plan in which litter records at fifty-six days are kept and the pigs are later judged from the standpoint of type, dressing percentage, and cutout values. In order to qualify, gilts must raise seven pigs weighing 225 lb. at fifty-six days, and sows must raise eight pigs weighing 250 lb.

Developing a Grade Herd of Hogs. As indicated in Table 13, remarkable improvements can be brought about in the pigs of the first generation from sows of common or nondescript breeding if a good purebred boar is used.

On the other hand, the undesirable results from a boar of questionable breeding as compared with a purebred boar are shown by experiments conducted at the University of Missouri. Boars were mated to similar sows. It was found that the offspring of the purebred boar reached market weight in 6 weeks' less time and at a cost of $1.25 less per 100 lb. than the offspring of similar sows not sired by a purebred boar.[10]

The producer of market hogs usually does not maintain sows that are purebreds. However, whether he is a producer on a large or small scale, it is to his advantage to use a purebred sire. As has been shown, sows of inferior breeding can be mated with a purebred sire and marked improvements brought about for one or two generations. If still higher levels of efficiency are to be reached, it becomes increasingly necessary to use greater care in the selection of sows from those produced in the grading-up process and in the purchase of purebred boars from outside sources to be used on these sows. Methods of selecting such a boar are similar to those used by a purebred breeder, as described on previous pages.

Crossbreeding for Producing Market Hogs. As described earlier, crossbreeding is being used to a considerable extent in the production of market hogs. Experiments in general have shown that crossbred pigs reach market weight faster and on less feed than comparable purebreds. Crossbred gilts frequently produce larger litters and are better mothers than comparable purebreds, as shown by the gains of the pigs during the suckling period. These differences are not large, and they

[10] *Circular* 225, College of Agriculture, Columbia, Mo.

may not hold true in every case, but they are sufficient to justify consideration of crossbreeding by breeders of market hogs.

If a breeder decides to undertake crossbreeding, there are two methods that have been shown to be desirable.

Method A. Start with purebred or high-grade sows of one breed and mate them with a purebred boar of another breed. Select gilts from the litters coming from these matings, and breed them to a purebred boar of the first breed. Gilts from this generation are bred to a purebred boar

FIG 208 Crossbred pigs, such as these make rapid and economical gains (*Minnesota Experiment Station*)

of the other breed From this point on, alternate with boars of the two breeds used. This process of selecting gilts in each generation and alternating with purebred boars from two breeds is frequently referred to as "crisscross" breeding.

Method B. This is known as the "three-breed cross." Start with purebred or high-grade sows, and mate them with a purebred boar of another breed, as in the method described above. However, mate these first-cross females to a boar of a third breed. From that point on, purebred boars of the three breeds are rotated

There seems to be little difference as to which of the common breeds to choose for crossbreeding. While crosses between certain breeds will lead to greater uniformity of color than between other breeds, this is not important, as packing houses pay for what is under the skin and hair. Preferably, breeds should be chosen that are popular in a given locality or region so that purebred boars can be readily obtained.

In crossbreeding, as in grading up or in producing purebreds, care must be used in selecting sows and boars if continued improvement is to be brought about. Production- or progeny-testing methods as previously described for both sows and boars are important.

Crossing Inbred Lines. A recent development in swine breeding is the crossing of inbred lines. A suitable inbred line is produced as the result of several generations of matings between close relatives. An inbred boar thus produced is mated with noninbred sows or with inbred sows not related to the boar selected. The crossing of two inbred lines within the same breed results in offspring known as "crosslines." In the future, these methods may be used more frequently in the improvement of purebred herds.

The crossing of inbred lines of different breeds has some promise as a system of crossbreeding hogs for commercial production. As yet, experiments are somewhat limited on these methods of breeding.

3. Breeding and Improving Dairy Cattle

In breeding and improving dairy cattle, some of the same principles hold true as for other kinds of livestock. The owner of a dairy herd is interested primarily in securing high production per cow in terms of butterfat and milk, since, within reasonable limits, the higher the production per cow the greater the profit. The importance of securing high production is discussed in the opening portions of this chapter. While a fairly high production can be maintained by culling out large numbers of cows, the alert dairyman is interested in improving the level of inheritance in his herd so that more and more of the heifers raised prove to be high producers when they reach maturity. Thus, in selecting cows and bulls for breeding purposes he strives to secure individuals that transmit high production to most or all of their offspring.

Improving Production. The progressive dairyman is interested in bringing about steady improvement from year to year in the production of his dairy herd. An example of steady progress over a period of years is shown in Table 20 for a dairy herd in Pennsylvania in which all fe-

males were bred and raised in the herd The production is averaged by 5 year periods, for in occasional years the production showed a slight decrease from the preceding year The figures show a steady progress over a period of 26 years, starting with an average butterfat production in the first 5 year period of 327 lb and a production average of 534 lb in the most recent year [11]

TABLE 20 AN EXAMPLE OF IMPROVED PRODUCTION IN A DAIRY HERD OVER A PERIOD OF YEARS

5 year periods	Averages lb per year, 5 year periods	
	Av yield of milk per cow per year	Av yield of butterfat per cow per year
1916–1921	9 744	327 0
1921–1926	10,156	351 0
1926–1931	11 487	401 0
1931–1936	12 696	441 0
1936–1941	13 609	449 0
1941–1942	14,697	534 0

It should be emphasized that steady improvement in this herd was due to many factors, such as keeping records year after year and culling out low producers, proper feeding, and controlling diseases and parasites However, one of the most important factors was the gradual improvement of the inheritance in the herd by using bulls and cows that transmitted high production to their offspring

Continuous records are important in herd improvement, as shown in Table 21 The figures in this table show that the men who stay in D H I A's the longest have the best herds [12] To a considerable extent, this herd improvement is probably due to the intelligent use of records in culling out low producers and finding cows and bulls that transmit high production to their offspring

Some interesting data on the long time improvement of dairy cattle in Denmark are available for the 30 year period from 1900 to 1930 For herds enrolled only in the "control societies" (similar to the D H I A's in the United States) the average production in 1900 was 235 lb of butterfat, in 1930 it was 317 lb, or an increase of 82 lb For herds enrolled in control societies and in breeding societies (similar to bull asso-

[11] First Progressive Holstein Breeders in Pennsylvania *Hoard's Dairyman* Nov 10 p 630 1943

[12] *Herd Builder* vol 4 No 4 (Apr 25 1944)

TABLE 21 DATA FROM D H I A 's IN IOWA TO SHOW VALUE OF CONTINUOUS TESTING

No of Years Herd Was Tested	Average Production, Lb , of Butterfat per Cow per Year
1	301 8
2	317 4
3	318 8
4	324 9
5–10	335 1
Over 10	356 0

ciations in the United States), the production over the 30 year period increased from 227 to 374 lb , or a total of 147 lb These records emphasize the desirability of keeping continuous production records and of improved breeding through using superior sires It is of interest to note that herd-testing associations and bull associations had their origin in Denmark In Denmark, 43 per cent of all dairy cows were on test in control societies in 1938, and the production average for all cows in that country was 277 lb of butterfat as compared with an average of about 180 lb in the United States, where less than 5 per cent of the cows are included in D H I A 's[13]

In many departments of vocational agriculture, through junior D H I A 's the boys are keeping records on their home farm herds, and the boys and their fathers are using the records for improving the pro duction in these herds In Tables 22 and 23, this type of data is shown for some herds in Michigan for a recent year

TABLE 22 DATA ON PRODUCTION IN 48 DAIRY HERDS GROUPED BY THIRDS *From Records Completed in 1943–1944 by Boys in Five Departments of Vocational* Agriculture in Michigan

	Low third	Middle third	High third	All herds
Number of herds	16	16	16	48
Range in butterfat	174 4–294 5	294 6–333 4	333 5–413 2	174 4–413 2
Av lb of butterfat	250 8	307 3	367 5	306 4

As shown in Table 22, the low third of these herds averaged 250 8 lb of butterfat, the middle third 307 3 lb , and the high third 367 5 lb , with an over all average of 306 4 lb In Table 23, the figures show, for example, that 4 1 per cent of these herds averaged 200 lb or less and 27 1 per cent produced between 351 and 400 lb , with only one herd, or 2 1 per cent, above 400 lb

[13] E J PERRY, Among the Danish Farmers p 87, The Interstate Danville Ill , 1939

TABLE 23 DATA ON PRODUCTION IN 48 DAIRY HERDS GROUPED ACCORDING TO BUTTERFAT AVERAGES

From Records Completed in 1943–1944 by Boys in Five Departments of Vocational Agriculture in Michigan

	200 lb and below	201 lb to 250 lb	251 lb to 300 lb	301 lb to 350 lb	351 lb to 400 lb	401 lb and above
No of herds	2	4	14	14	13	1
Per cent of herds	4 1	8 3	29 2	29 2	27 1	2 1
Av lb of butterfat	177 7	229 6	273 9	318 3	363 9	413 2

Every dairyman should set up a goal in terms of the average production that he will strive to secure during the coming year and over a longer period Some boys at Williamston, Mich , together with their fathers, set goals for their home farm herds on which they kept records and carried out various improvement practices These figures are shown in Table 24

TABLE 24 EXAMPLES OF GOAL SETTING AND ACCOMPLISHMENTS IN IMPROVEMENT PROJECTS IN DAIRYING IN VOCATIONAL AGRICULTURE AT WILLIAMSTON MICH

Herd owner	First year	Second year	
	Av butterfat (actual) lb	Goal lb	Av butterfat (actual) lb
R.A	382 4	375 0	360 0
C B	316 6	340 0	294 4
F C	319 7	340 0	378 8
F E	284 0	305 0	262 1
H H	226 0	240 0	274 6
F K	350 8	360 0	398 3
G L	264 4	300 0	298 2
F P	329 0	340 0	314 4
J R	314 1	324 0	339 5
E R	345 9	355 0	370 3
W S	319 1	329 0	306 7
M T	365 4	350 0	264 6

Data in the preceding tables in this chapter are helpful in setting goals. For a dairyman just starting to improve his dairy herd, an average of 275 to 300 lb per cow is a reasonably good objective (If the herd is at a low level of improvement or if it consists of a large percentage of heifers, such an average may be too high) Over a period of a few years

of keeping and using records of production, 350 lb. is a creditable average. If increasingly better improvement practices are used, it is possible to develop a herd averaging 375 to 400 lb. or more.

Improving Breeding Efficiency, or Calving Percentage. As another consideration in breeding and improvement, the breeder of dairy cattle is interested in maintaining a high rate of reproduction in his herd. This is frequently referred to as "breeding efficiency" or "calving rate." Experiments at the University of Idaho show a yearly production of 385 lb. of butterfat for cows calving an average of every 11 months and only 297 lb. for those calving every 18 months.[14] Freshening regularly at least every 12 months, with 6 to 8 weeks as a "dry," or rest, period between lactation periods, seems to be most desirable. This results in a favorable annual production and a large number of calves for herd replacements and sale.

The average dairy cow calves only once every 14 months, which means that every 100 cows produce only 80 to 90 calves per year. Consequently, the average dairy herd has an estimated calving percentage of about 85. (If each 100 cows produced 100 calves, there would be a calving percentage of 100.) The calving percentage in a herd may be low because of careless breeding and failure to breed the cows back soon enough after freshening. Sometimes a low percentage may be due to Bang's disease or other ailments of the cows or may result from using a bull that is not a reliable breeder. It is desirable for each herd owner to work toward a goal of 90 to 100 per cent calf crop in his dairy herd.

Improving a Purebred Herd of Dairy Cattle. In the long run, the owner of a purebred herd from which breeding animals are sold will succeed only if his cows are good producers and the herd has a reputation for transmitting good production uniformly to the offspring. Of course, in selecting the animals for his herd, he will give some attention to appearance or type, to pedigree, and to breed characteristics, primarily because these have sales value in disposing of surplus stock. However, the buyers of purebred animals for breeding purposes are giving increased emphasis to evidences that these animals will produce offspring of merit in terms of production. Therefore, the breeder of purebreds must expect to meet these demands in the animals which he sells.

In improving a purebred herd, the progeny test becomes a very useful tool. In fact, it has so far demonstrated its usefulness most effectively in dairy cattle breeding.

[14] *Country Gentleman*, August, 1944, p. 26.

Securing Prepotent Bulls Reliance on type, pedigree, and production of close up ancestors is likely to prove disappointing in selecting a sire that will bring about improvement in a given herd, particularly a herd already producing on a fairly high level Table 25 provides further

TABLE 25 WHICH BULL WILL YOU SELECT?

	Sire *A*	Sire *B*	Sire *C*	Sire *D*
Rating of bull on basis of type	First	Second	Third	Fourth
Production of bull s dam lb				
Milk	16 997	12 540	8 482	11 984
Butterfat	663	707	436	631
Production of granddams, lb				
Paternal (sire s s dc)				
Milk	7 267	16 786	12,312	16 872
Butterfat	384	751	729	754
Maternal (dam s s dc)				
Milk	Unknown	16 997	Unknown	9 177
Butterfat	Unknown	663	Unknown	502
Average production of cows mated lb				
Milk	6 427	7,261	7,795	8 024
Butterfat	326	326	383	380
Average production of daughters lb				
Milk	7 551	6 246	9 092	8 398
Butterfat	367	293	455	407
Increase or decrease in production lb				
Milk	+1 124	−1 015	+1 297	+374
Butterfat	+ 41	− 33	+ 72	+ 27
Index of bull, lb				
Milk	8 675	5 231	10 389	8 772
Butterfat	408	260	527	434

evidence of the shortcomings of these methods in selecting sires The information shown on type production of the bull s dam, and production of granddams was all available at the time the bulls were sold They were used in Michigan herds on cows of the production level shown When the records of the daughters became available, the results were somewhat startling If one were picking a bull on type or appearance and on the production of the bull s dam, as is too often the case sire *A* or sire *B* would be selected Sire *B* had close up ancestors all of which were high producers and he was second in type yet his daughters were by far the lowest producers of any of the bulls Bulls *C* and *D* proved to be the best from the standpoint of bringing about improvements in production as revealed by the index of each computed from the informa

tion on the cows and their daughters. As will be explained later, the index of a sire is an indication of his value in a herd and thus can be determined only by comparing the production of his daughters with the production of their dams, to which he was mated.

For use in a purebred herd, it is preferable to secure the services of a sire proved to be a transmitter of high production. If this is not possible, secure a son of a good, proved sire out of a cow with high-producing daughters (or out of a daughter of a good, proved sire).

A breeder may be able to prove a sire already in use in his herd, or he may be able to use the services of a good, proved sire owned by another person. In some cases, he may purchase such a sire cooperatively with other farmers. Artificial insemination may be useful in securing the services of a good sire, as explained later.

The Bureau of Dairy Industry of the U.S. Department of Agriculture considers a sire proved when the production records of at least five of his unselected daughters have been compared with the production records of their dams. (All records are computed to a 305-day mature basis.) Such records may show that a sire has transmitted high, medium, or low producing ability to his daughters, and these daughters may average more or less than their dams. Thus, in considering a sire that is "proved," determine whether he has been proved to be good or poor from the standpoint of his transmitting ability.

If the daughters of a sire excel their dams in production by a margin of 25 lb. or more of butterfat per year, the sire can be safely said to be raising the level of production in that herd. His use should be continued in that herd or in herds of similar production levels. If the daughters of a sire equal approximately the production of their dams, it may be desirable to keep him in the herd until a better sire can be secured. If the production of the daughters is materially lower than that of their dams, the sire should not be used longer in that herd, although he might be good enough to use in lower producing herds.

The information in Table 26 provides a basis for proving two bulls.

Obviously, in the herds where they were used, bull *A* has proved himself to be a good sire for bringing about improvement, whereas bull *B* has proved to be a poor sire in terms of the production level of his daughters. Actually, the second sire might be a fairly good one for use in a herd in which the cows were lower producers than those shown.

In indicating the level of production that a sire transmits to his offspring, the equal-parent index is sometimes used. The "equal-parent"

TABLE 26 INFORMATION FOR PROVING TWO DAIRY BULLS

	Mature equivalent		
	Milk, pounds	Test, per cent	Butterfat pounds
Information for Proving Bull *A*			
Average of 10 daughters	10 559	4 8	504
Average of their 10 dams	8 526	5 1	438
Increase of daughters over their dams	+2 033	−0 3	+ 66
Information for Proving Bull *B*			
Average of 6 daughters	11 048	3 6	398
Average of their 6 dams	12 616	3 6	448
Decrease of daughters below their dams	−1 568	0 0	− 50

index is based on the assumption that for all practical purposes the sire and dam each contributed equally to the inheritance of the daughters In computing the index, the average production of the daughters is assumed to be midway between the average production of their dams and the level of production that the sire is capable of transmitting To be most dependable, the sire index should be computed from a large number of selected daughters and their dams, all of which were raised and fed under similar conditions In the case of the foregoing sires, the bull index of bull *A* is 570 lb of butterfat This is computed by first noting the amount by which the production of the daughters has been increased This is 66 lb Since the production of the daughters is halfway between the production of their dams and the index of the sire, the index of the sire is found by adding 66 to 504, which gives 570 lb of butterfat as the index Since bull *B* lowered the production of the daughters 50 lb under that of their dams, his index would be 50 less than the production of his daughters, or 348 lb of butterfat

Through the U S Department of Agriculture, Bureau of Dairy Industry, 10,000 sires have been proved from records kept on the cows to which they were mated and on the daughters produced from these matings [15] A summary of the effects of these sires on the production of their daughters is shown in Table 27 These data show that, in general, as

[a] Table adapted from Ten Thousand Proved Sires *Hoard's Dairyman* Mar 25 1944 p 170 and report from U S Department of Agriculture Bureau of Dairy Industry

the production level of the cows increases the likelihood is less that their daughters will be improved. For example, sires used on cows producing 250 lb. of butterfat or less resulted in daughters with a production averaging 37 lb. over that of their dams. With cows producing over 500 lb., the daughters had a production average of 64 lb. less than their dams.

TABLE 27. EFFECTS OF 10,000 PROVED SIRES ON THE PRODUCTION OF THEIR DAUGHTERS

Range of butterfat production of cows bred	No. of sires that increased production	No. of sires that decreased production	No. of dam-and-daughter pairs	Change in production of daughters, lb.
Under 250	115	38	1,155	+37
250–299	667	324	8,267	+20
300–349	1,605	1,205	26,037	+ 8
350–399	1,580	2,018	35,051	− 5
400–499	773	1,571	21,108	−21
500–649	14	90	807	−64
Total or av.	4,754	5,246	94,425	− 2

The data in Table 27 indicate that approximately 3 out of every 4 sires mated with cows in the low-producing group improved production through their daughters, while there was an increase by only 1 out of 7 of the bulls used on cows in the high-producing group. For all cows producing less than 350 lb., 6 out of 10 sires increased production. For the cows producing 350 lb. or more, the daughters on the average declined in production, and only 4 out of 10 sires increased the production. These figures show the increasing difficulty of securing sires that increase production in herds already producing on high levels.

A long-time experiment in dairy-herd improvement has been conducted at the U.S. Government Experiment Station at Beltsville, Md. Only proved sires have been used that had previously demonstrated themselves to be able to transmit high production to their daughters. For a period of 25 years, with these high-caliber sires, the production level of the herd has been consistently raised even though it was at a high level at the beginning and no selective culling of females has been practiced. This experiment shows what can be accomplished in herd improvement through the use of sires known to transmit high production.

Many owners of purebred herds will need to continue to select young bulls for use in their herds, since few proved sires are available. Such persons should keep production records on the cows bred and on the daughters sired by such a bull so that he will be proved as early as pos-

sible At best it takes till a bull is about five years old to get sufficient information to prove his worth If he goes into service as a yearling, his first calves will be born when he is about two years old These will freshen when he is four years old, and records for their first lactations will be available when he is five years of age Since there must be a minimum of five daughter dam comparisons, it may actually take until he is six or seven years of age to prove whether he is an asset or a liability

In addition to evidence of ability to transmit high production, it is desirable for the purebred breeder to pay some attention to evidences of transmitting desirable type and breed characteristics Some attention to shape of udders, straightness of topline, and constitution or heart girth is also important

Using Artificial Insemination As mentioned earlier in this chapter, artificial insemination is a method for extending the number of offspring possible from a good dairy bull Some of the advantages of this method are as follows

1 Sires can be proved at a younger age than with natural methods of mating This is because the sire may be used before he is old enough to mate naturally, and on more cows
2 Increased use can be made of a sire once he is proved Under favorable conditions the semen from one bull is sufficient for inseminating upward of 2 000 cows per year, about twenty times as many as by natural methods
3 The expense and risk to dairymen are less than for keeping a bull on each individual farm This is a special advantage in small herds
4 Valuable sires that are unable to serve cows naturally can be continued in use
5 Under carefully controlled conditions disease control is more effective
6 Cows can be inseminated at a considerable distance from the sire, by transporting the semen

Some of the limitations of artificial insemination are

1 A well trained and reliable operator is needed
2 Organizations of herd owners are highly important if the work is to be carried out effectively (this is explained in a later paragraph)
3 Sires of proved ability to transmit high production are difficult to secure

In carrying on artificial insemination dairymen form organizations for owning sires and employing persons to do the work of insemination

These organizations, which are being started in many states, are frequently called "artificial breeding associations." The number of dairy farmers using artificial insemination is increasing rapidly.

The present tendency in artificial breeding is to keep bulls in a central organization in which the semen is secured under carefully controlled conditions. Some of these organizations are set up for an entire state, the bulls and facilities being owned cooperatively by the farmers, who participate through outlying or local units. Each local unit consists of members whose herds are within a radius of a few miles. To be most successful, upward of 1,000 or more cows, preferably of not more than two breeds, are signed up in each local unit. A trained person in each association receives the semen at regular intervals, usually by mail, from the central organization. He is notified by the local farmers when cows are to be served, and he administers the semen to them. The whole setup is usually financed by fees paid by local members.

In a recent year in the United States, more than four million dairy cows in about half a million herds were included in artificial breeding associations. This was about one-sixth of all dairy cows in that year.

In some of the Eastern states, where artificial insemination has been carried on for some time, it has been found that in the first generation of calves an average gain in production of 30 to 42 lb. of butterfat per year was obtained over the mother cows.

Using Other Organizations for Owning Sires. It is possible by various methods for dairy farmers to organize for securing good sires and for keeping them in circulation until they are proved. These include bull associations in which several farmers purchase sires together, each farmer keeping one bull for a period of 1 or 2 years and the bulls being rotated. Another method, for smaller herds, is for a large number of farmers to purchase sires for each four to six herds. Each sire is used in the herds of a given "block" of four to six farmers and after a certain length of time is rotated, or traded, for a sire in another block. In all cases, the farmers must agree on methods of disease control and in other ways develop methods that meet the approval of the entire group. In a recent year, there were 306 dairy bull associations in the United States, including some 6,000 farmers who owned 1,392 bulls for use on about 53,000 cows.

Selecting Prepotent Cows. While the sire is half of the herd, the cows are the other half and are also important in herd improvement. As with the bull, the true test of a dairy cow as a breeder is the kind of progeny she produces. It is not the production record of the cow that

counts, but the records of her daughters and the ability to transmit a high level of inheritance to her sons

Two cows may produce alike, but when bred to the same bull one may have daughters that are uniformly good producers and the other have some or all daughters that are low producers A breeder of purebred cattle desires to have cows in his herd that are prepotent for high production, as shown by superior records of most or all of their daughters Often, individual cows are found in a given herd that are superior in this respect These become "brood cows" for the herd, in that their daughters are used for herd replacements The early recognition of such prepotent cows in a herd often makes it possible to build the herd around a few prepotent strains, or "cow families" as they are sometimes called

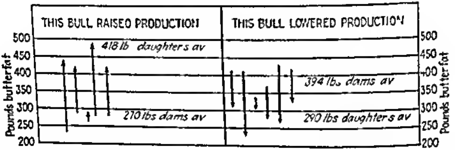

Fig 209 Two proved dairy bulls one of which raised production while the other lowered it. The five daughters of the bull at the left increased average butterfat production from 270 lb for their mothers to 418 lb as an average for their own production The six daughters of the bull at the right decreased from an average of 394 lb of butterfat for their mothers to 290 lb as an average for their own production (*Minnesota Experiment Station*)

A Holstein cow at the Wahpeton Indian School of North Dakota is an example of a good brood cow Before her death at seventeen years of age she built up an outstanding lifetime record of milk and butterfat production, but, what is more important, she produced 11 daughters and 3 sons Most of her daughters proved to be high producers, as was true of their offspring when they reached producing age In a recent year, all the herd of 35 cows at that institution were direct descendants of the original Holstein cow

Another example of a brood cow that started an outstanding cow family is found in the records of a D H I A in Michigan This cow, with an average production of 389 6 lb of butterfat in four lactations, had six daughters all of which averaged more than 400 lb of butterfat in two or more lactations for each The daughters were consistently good

producers even though three different bulls were represented as their sires, which indicates the likelihood that their mother was especially prepotent for high production.

From the above, the importance of continuous testing in a herd is indicated, as this is needed in order to check on the production of daughters of individual cows as well as of individual sires. Furthermore, lifetime records on cows are desirable for securing long-lived and persistent producers for breeding stock.

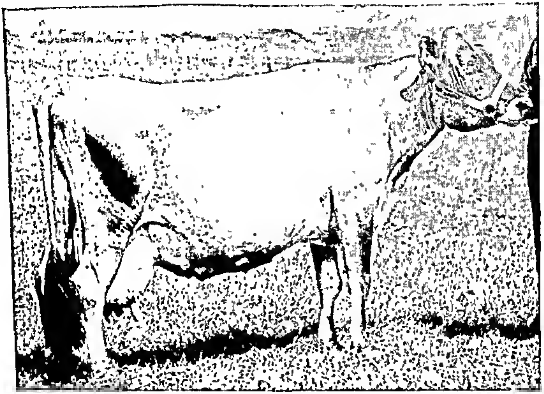

FIG. 210. A cow with an outstanding lifetime production. This cow, Silken Lady's Ruby of F., had a lifetime record of 196,457 lb. of milk containing 10,936 lb. of butterfat on twice daily milking. During her lifetime, she gave birth to 18 calves, many of which inherited her high producing qualities. Picture shows her at twenty-one years of age. (*American Jersey Cattle Club.*)

Using Additional Methods for Improving Purebred Herds. The importance of owners of purebred herds becoming members of D.H.I.A.'s or in other ways providing for keeping records on all cows in their herds has been emphasized. Each breed registry association has a program for securing official or advanced registry records for recognition of individual cows, and most of them also have provisions for recognition of herds that produce at a high level.

Most breed registry associations also have provisions for herd classification on the basis of type for breeders who wish to take advantage of these

services. In this work, an official judge classifies each cow in the herd on the basis of such characteristics as size, form, and quality. By culling cows with low production records and low ratings on type as indicated by the classification judge, a breeder may be able to make greater progress in building up a herd with high production and approved type or form.

Developing a Grade Herd of Dairy Cattle. An owner of common or nondescript cows need not dispose of these cows in order to develop a herd of reasonably good producers. In order to bring about improvement, the use of good purebred sires is necessary for the process previously described as "grading up." One of the earliest experiments on grading up was carried on with some scrub cows at Iowa State College.[16] The data for three generations in this experiment are shown in Table 28.

TABLE 28. RESULTS OF USING PUREBRED SIRES ON SCRUB COWS AS FOUNDATION FEMALES

Group	No. of cows	No. of lactations	Average production, lb	
			Milk	Butterfat
Scrub dams	5	23	3,660.2	171.6
First generation grades	5	21	5,998.7	261.3
Second generation grades	5	6	8,401.9	358.2

As these data show, each of the granddaughters produced as much as two of the original scrub cows.

In order to continue to improve a grade herd, sires must be carefully chosen. As previously shown, when cows reach a production level of around 350 lb. of butterfat, it is difficult to secure sires that when mated to the cows will boost the production of the herd still higher through their daughters. In fact, it becomes necessary for a herd owner to give careful attention to securing sires known to be prepotent in transmitting high production and cows which are likewise prepotent. At this stage in herd development, he will wish to utilize many of the suggestions given on previous pages for selecting sires and cows for improving purebred herds.

In developing a grade herd, the importance of using good, purebred sires cannot be overemphasized. The continued use of bulls of unknown breeding is a menace and disgrace to dairy farming. In some cases, "stockyard" bulls of questionable breeding are loaned to farmers to use on their herds. These bulls are usually quite young when first placed on

[16] Influence of Environment and Breeding in Increasing Dairy Production. *Bulletin* 165, Iowa State College, Ames, Iowa, 1916.

the farms. After a period of growth, they are replaced by younger bulls, also of unknown breeding. The promoters of such programs are persons who make considerable money on the increase in weight of the bulls as they mature at the expense of the farmers using them. Needless to say, the bulls are usually a detriment to the herds in which they are used.

Owners of good grade herds will benefit by belonging to D.H.I.A.'s or by using other means for keeping continuous records of production on each cow, as discussed in previous portions of this chapter and in Chap. 8.

Crossbreeding Dairy Cattle. Experiments by the U.S. Department of Agriculture have shown that crossbred dairy cows produced more than did cows from matings of similar animals within one breed. Good parent stock is needed to secure these results from crossbreeding. More experiments are needed to determine the full benefits from crossbreeding, but results to date from various crosses among the common dairy breeds show considerable promise, as indicated above.

Experiments are being conducted on crossbreeding between the common dairy breeds and the Red Sindhi breed, one of the better milking breeds of Brahmans. This breed, like other Brahmans, is able to withstand high temperatures. These crosses are being made in an attempt to secure dairy stock which will produce well under the high temperatures of the Southern states. As yet, the results of these experiments are not complete.

4. Breeding and Improving Beef Cattle

In improving a breeding herd of beef cattle, it is important that the breeder select bulls and cows which produce offspring of the desired type and do it consistently. Animals that grow fast and thus increase in weight rapidly have been found to be desirable, as they produce beef at the lowest cost per pound and reach market weight in the shortest time. Consequently, animals for breeding purposes should develop rapidly and should transmit this tendency to their offspring. In experiments at the University of Minnesota and elsewhere, it has been found that, in general, beef animals that develop rapidly are most economical in feed requirements per 100 lb. of gain. Heifers in thrifty condition should weigh 375 to 500 lb. at six months of age and 650 to 750 lb. as yearlings. Bulls at corresponding ages should weigh 450 to 600 lb. and 750 to 1,000 lb., respectively.

Another important factor in improving a beef herd is that of securing a high calving percentage. Methods of figuring calving percentage are discussed on page 357 in connection with dairy cattle. A high calving percentage has been found to be one of the most important factors affecting profits in beef cattle production on ranches and farms. The beef herd on the average farm frequently has a calving percentage of 75 or less. A herd should be expected to show a calving percentage of at least 95, and a beef breeder should seek to equal or exceed this. On

FIG 211 Ability to make rapid gains is desired in beef animals. The animal on the left is a slow gaining poor type animal of nondescript breeding. The one at the right is a fast gaining good type animal of improved breeding. (*Bureau of Animal Industry U.S. Department of Agriculture.*)

the range many herds drop to 60 per cent or less, whereas a rancher should strive to secure upward of 90 per cent under range conditions.

As with other kinds of livestock prepotency is important in breeding beef cattle. Bulls that look equally good may transmit differently. For example, in experiments at the University of California, three bulls were used that appeared to be equally good. They were bred to similar cows and the daughters were raised alike. The daughters from one bull averaged 635 lb at twelve months, from the second bull 690 lb, and from the third bull 730 lb.

Improving a Purebred Herd of Beef Cattle. Since an owner of a purebred herd of beef cattle secures most of his income from selling breeding stock, he should attempt to select animals for use that are prepotent for the desired type and rapidity of gain or growth.

Selecting Prepotent Bulls. Beef bulls are proved in a different manner from dairy sires. It is possible to prove a beef sire at an earlier age than a dairy sire because the qualities desired in beef offspring can be checked fairly young. Uniformity of the offspring in type or appearance and their consistency for rapid gains in weight can be determined during the first year of their lives. Bulls to prove themselves good must sire calves that are uniformly good in type and rate of gain.

TABLE 29. PERFORMANCE RECORD FOR BEEF CATTLE

Animal No ________ Sex ________	Birth date ________ Birth weight ________
Sire ________	Dam ________
Date weaned ________	Date finished ________
Age at weaning ________	Age ________
Total gain ________	Total gain ________
Daily gain ________	Daily gain ________
Score at weaning* ________	Score at end of test* ________

* This refers to an estimate of an animal's appearances in terms of approved beef type

If possible, a breeder of beef cattle should secure a tried, or proved, sire, that is, one which has proved himself prepotent in the respects indicated above. If a tried, or proved, sire is not available, the herd owner should prove the bull or bulls in use in his herd through proper records and observations. The method is not as clear-cut as in the case of proving dairy bulls. Merely observing the early development of calves sired by a given bull is of considerable value. The bull who sires calves that are uniformly good at a given age is a "better bet" than an untried sire, regardless of his appearance or pedigree. Additional information is desirable, however, in proving a beef bull, including weight of calves at specific ages, such as six and twelve months, to note growth rate.

The type of record in Table 29 has been worked out jointly by the U.S. Department of Agriculture and the Minnesota Experiment Station.

The preceding record form is of value for keeping records useful in proving a beef bull by the performance of his offspring. Information of this kind is also of value in sizing up a young bull that is untried.

In selecting a young bull, secure one that is of approved type and a rapid gainer himself and sired by a bull known to be a rapid gainer and the sire of rapid-gaining calves A young bull should also be out of a cow that was a rapid gainer and the dam of rapid-gaining calves If possible, inspect some of the brothers and sisters and half brothers and half sisters, and note whether or not they are uniform in type

Experiments by the U S Department of Agriculture show that the ability of a beef animal to gain in weight cannot be determined from the conformation of the animal These experiments on the selection of beef bulls have shown that bull calves which gain most rapidly after weaning, from about six to ten months of age, are the most likely to sire calves which gain rapidly In reality, this check on gains of young beef bulls represents a performance test The ability to gain rapidly is highly heritable Bulls may be put on special tests from about six to ten months of age to select the ones which gain most rapidly During this test, they should be kept under similar conditions and fed good rations In a few instances, central testing stations are being developed by breeders to carry on these tests with young bulls Perhaps, in the future, this method of testing bulls may be more widely used

In some cases, after superior family lines are found, some degree of inbreeding is adopted by using principally the bulls from these lines within the herd

Selecting Prepotent Cows In a purebred herd, retain cows that produce rapid growing offspring of a desired type, as previously explained for a sire Records of the kind shown in Table 29 are useful in sizing up her offspring Studies at the New Mexico Agricultural Experiment Station show that the weaning weight of the first calf of a beef cow is a good index to weights of future calves from the same cow Consequently, in improving a herd, choose cows whose calves are the heaviest at weaning age

In addition to the performance of offspring in terms of rate of gains and general type, other factors to consider in deciding what cows to retain include (1) regularity as a breeder, (2) age, (3) milking qualities, and (4) degree of uniformity in type or appearance with other cows in the herd To maintain a high calving percentage in the herd, retain cows that produce calves regularly Usually, it pays to cull any cows that fail in two successive years to produce live calves

By keeping a careful check on offspring from various cows in a herd, it is frequently possible to find strains, or families, that are especially prepotent with respect to desired type and rapidity of gains, similar to finding families consistently high for production as described in connection with dairy cows For replacements, retain heifers from these cow lines

Developing a Grade Herd of Beef Cattle. Through the use of purebred beef sires, it is possible to develop a grade herd from common or nondescript cows, in a manner similar to that used in grading up other kinds of livestock The value of purebred sires on scrub cows has been demonstrated in several tests at the Oklahoma Experiment Station, as well as other stations Table 30 shows data from an experiment in Oklahoma that indicates the improvements possible through using purebred sires [17]

TABLE 30 VALUE OF PUREBRED BEEF SIRES IN IMPROVING OFFSPRING FROM SCRUB COWS

Type of mating	Gain per day, lb	Cost of feed per 100 lb gain
Scrub sire and scrub dams	1 67 lb	$8 58
Purebred sire and scrub dams	1 88	8 32
Purebred sire and high grade dams	1 97	7 72

The scrub steers sold for $1 71 *less* per 100 lb than the purebred grade cross and $0 92 less than the purebred scrub cross

Selecting Prepotent Sires Marked improvements for a generation or two can be brought about by using fairly good purebred bulls on inferior cows However, as the second and third generation cows secured from this grading process are used in the breeding herd, it becomes increasingly necessary to secure sires that are highly prepotent along desired lines Most of the suggestions made for selecting sires for a purebred herd are applicable under these conditions

Selecting Prepotent Cows Select carefully all cows to be kept in a grade herd The suggestions for determining prepotent individuals given in connection with purebred cows are of value

Crossbreeding for Producing Market Beef Cattle Crossbreeding, as yet, has not been used much in the production of beef animals for

[17] F B MORRISON, 'Feeds and Feeding, p 638, The Morrison Publishing Company, Ithaca N Y, 1936

the market Some recent experiments by the U S Department of Agri culture, Bureau of Animal Industry, show some promising possibilities along this line [18] The triple cross, or three breed cross (described earlier in this chapter in connection with swine breeding, page 351), has been found to show the following advantages as compared with purebreds (1) heavier weaning weights of calves, (2) greater gains during the feeding period, (3) more uniformity in gains and finish, (4)

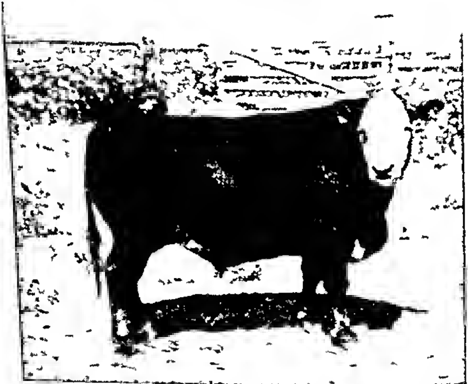

FIG 212 A three breed-cross steer The mother of the steer was sired by a Shorthorn bull and out of a Hereford cow The steer was sired by an Aberdeen Angus bull (*Bureau of Animal Industry U.S Department of Agriculture*)

greater returns above production costs However, the differences in favor of crossbreeding are quite small in some cases Before cross breeding is widely adopted in beef production further experimenta tion is desirable An example of a steer from a three breed cross is shown in Fig 212

In Southern states, Brahman bulls are being used to cross with the common beef breeds The offspring from these crosses are hardy and thrive in hot weather (see Fig 213)

[18] Information from U S Department of Agriculture Bureau of Animal Industry

5. Breeding and Improving Sheep

The breeder of sheep is interested in two products from his flock, namely, lambs and wool. Consequently, his emphasis in flock improvement should be on the selection of ewes and rams that transmit to their offspring the desired characteristics of rapid growth, good market type, and heavy fleeces of good-quality wool. For both purebred and grade flocks, sheep breeders are also interested in a high lambing percentage, as this contributes to the pounds of lamb produced per ewe, which in turn is closely related to the amount of profit from a flock.

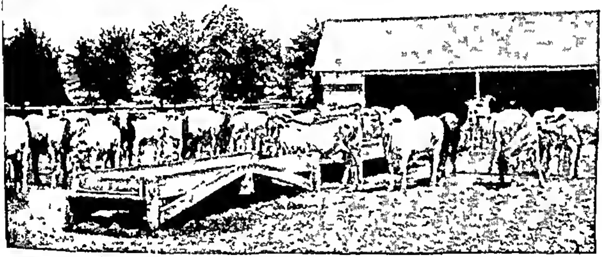

Fig 213 Some crossbred Brahman steers in the feed lot

In seeking to improve his flock of sheep, it is desirable for the breeder to use such measures of efficiency as have been mentioned above to measure the present level of efficiency. This is a challenge to him to set goals for the year ahead that indicate improvements in his flock. For example, in lambing percentage, the actual average of all flocks in many states is 100 per cent or less. Actually, a good sheep breeder under farm conditions should strive to secure a 125 per cent crop or more. Under range conditions, 90 to 95 per cent would represent a creditable achievement.

As an example of checking on present lambing percentages and setting goals for the future, Table 31 shows data for a 2-year period for some flocks near Onsted, Mich. Several boys taking vocational agriculture had sheep as ownership projects, or they conducted improve-

ment projects with their home flocks of sheep. (In the latter case, they cooperated with their fathers in bringing about improvements in the home flocks.) After checking on the lambing percentage in each flock for 1942, each boy (with his father in some cases) set a goal for the flock for 1943. As noted from the lambing percentages of the following year, in eight flocks these goals were equaled or exceeded. In nine flocks, the lambing percentages were increased over the previous year. In all flocks combined, the lambing percentage was boosted from 87 to 101 per cent. Many practices were involved in bringing about these improvements, including attention to better selection of ewes and improved breeding practices.

TABLE 31. DATA ON LAMBING PERCENTAGES IN TWO SUCCESSIVE YEARS, TOGETHER WITH GOALS SET, IN 12 FLOCKS IN A MICHIGAN COMMUNITY

Name	1942 crop of lambs			1943 goal, per cent	1943 crop of lambs			1944 goal, per cent
	No. of ewes	No. of lambs	Lambing percent-age		No. of ewes	No. of lambs	Lambing percent-age	
Royal Mc.	3	3	100	100	4	4	100	100
Walton J.	225	185	82	90	220	216	98	100
Wendle M.	24	25	104	100	25	21	84	100
Russell N.	9	8	88	100	9	10	111	115
Francis N.	40	35	87	100	45	42	93	100
Don S.	27	22	81	100	27	24	89	95
Charles S.	2	2	100	100	2	1	50	100
Morden M.	24	27	112	117	24	29	120	120
Hugh D.	22	26	118	120	22	27	122	125
Dick F.	45	41	91	100	51	54	106	109
Bob R.	36	31	86	100	36	40	111	115
Bob B.	32	22	68	90	39	37	94	100
Totals	489	427	87	...	504	505	101	

In many states, the average annual production of wool per sheep for the medium-wool breeds is 7 lb. or less. With better methods of flock improvement, it should be possible to increase this to 8 or 9 lb. In fine-wool breeds, the general average is around 9 lb., whereas it should be possible to increase this to 12 lb. or more. Many flock-owners, through proper breeding practices, can increase these figures to even higher levels.

As a general average over the entire country, the pounds of lamb

produced per ewe when the lambs are 135 days of age is 65 lb. or less. With improved lambing percentage, better selection of breeding stock, better feeding, and other improvements, this could be increased to 85 or 90 lb. or more. A good standard for individual lambs of medium-wool breeds and some of the improved range breeds is 80 lb. or more per lamb at 130 to 140 days.

In a recent year in Michigan, the average for 116 flocks in the Wolverine Lamb Production Contest was 96 lb. of lamb per ewe, and nearly half of these flocks produced 100 lb. or more per ewe. Over half of the flocks had a lambing percentage of 150 per cent or more. The best in this group was a purebred flock of a medium-wool breed in which the lambs averaged 90 lb. each at 135 days. In this particular flock, a 148 per cent lamb crop was raised, each ewe produced 131 lb. of lamb at 135 days, and the flock average in wool production was 10 lb. per fleece.

One method of computing production per ewe now in use in the Wolverine Lamb Production Contest in Michigan is to figure the "lamb credit" per 100 lb. of ewe in the breeding flock. Lamb credit for the flock as a whole is obtained by multiplying the total wool produced by 3, adding to this figure the total weight of the lambs at 135 days, and dividing this sum by the total weight in hundreds of pounds of the breeding ewes at mid-gestation. This method has been found to provide a better basis for comparing breeding flocks of all breeds. [The reason for multiplying the wool weights by 3 is that wool in general is worth about three times as much per pound (in the grease) as a pound of market lamb.] As an example, suppose we have a flock of 100 ewes averaging 140 lb. in weight. This flock produced 8,000 lb. of lamb and 800 lb. of wool. The combined weight of the ewe flock is 14,000 lb. The total lamb credit for the entire flock would be computed as follows:

$$\begin{aligned} 3 \times 800 = {}& 2{,}400 \text{ (lamb equivalent of wool produced)} \\ & \underline{8{,}000} \text{ (weight of lambs produced)} \\ & 10{,}400 = \text{total lamb credit for flock} \end{aligned}$$

By dividing 10,400 by 140, the figure of 74.3 is obtained, which is the average lamb credit per 100 lb. of ewe in the flock. If desired, a similar figure could be obtained separately for each ewe in the flock by making computations based on her weight, pounds of lamb produced by her, and her fleece weight. A very creditable accomplish-

ment for lamb credit per 100 lb of ewe would be 90 to 100 In a recent year, one flock in Michigan averaged 117 lb of lamb credit per 100 lb of ewe weight

Improving a Purebred Flock of Sheep Careful selection of ewes and rams is the key to improvement of a purebred flock As with other kinds of livestock, the best evidence of the value of an animal in a breeding flock is its ability to transmit the desired characteristics to its offspring The extent to which wool or meat is given greater emphasis or whether both will be equally emphasized depends on the purposes for which the breeder is raising sheep

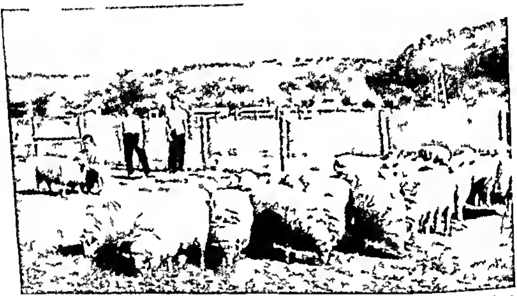

FIG 214 Ewes owned by several young sheep raisers placed in a community pasture in order to have the services of a good ram

Selecting Prepotent Rams The influence of the sire is highly important in bringing about improvement The proof of a ram s breeding value is the performance of his offspring as meat and wool producers and as breeders For purebred flocks of sheep secure tried or proved rams whenever possible Failing this secure the son of a ram whose offspring are uniformly good and out of a ewe with a good record of lamb and wool production Take steps to check on the transmitting ability of such a sire through records on the first crop of lambs with respect to rapidity of growth, type of lamb, and quality and weight of fleece

Usually, a ram is kept 2 years and then displaced unless breeding is to be carried on. An untried young ram may be introduced into a flock by using him on a few ewes for the first year and noting the quality of his offspring, as indicated in the preceding paragraph. If he proves his ability to transmit desired characteristics, he can be used more extensively the following year.

In selecting a ram, give preference to one of a pair of twins, as most flockowners wish to increase the number of twins in order to boost the lambing percentage. While the ram has little or no influence on the number of twins among his immediate offspring, he may

FIG 215 Students in Wisconsin selecting flock replacements by choosing ewe lambs on the basis of their type and weight, with due regard for the type of their mothers and the extent to which good qualities of the mothers show up in the offspring

transmit a tendency for increased twinning to appear in later generations

At Michigan State College, some progeny testing for rams is being carried on. The animals are leased as ram lambs or yearlings and their progeny checked as to weight at 135 days. The offspring are also checked on type and fleece characteristics as noted from close inspection. Thus, in proving a ram, emphasis is placed on growth rate of progeny in 135 days, uniformity of progeny, and breed type. In emphasizing growth rate and finish, it is of course necessary that the lambs be kept under conditions which permit them to develop best.

Selecting Prepotent Ewes In improving a purebred flock, give careful attention to the selection of ewes Retain ewes that produce heavy fleeces of good quality and that breed regularly In addition, give attention to the tendency for producing twins and to the characteristics of the offspring, including their rate of growth and amount and quality of wool The record of performance for ewes as developed in Michigan, or some modification of it, is helpful in deciding which ewes to retain in a flock (see Table 32) For each ewe, check the number of lambs raised each year and their weight and quality at a given age (such as 135 days) In addition, obtain the weight and quality of a year's growth of wool of each ewe

Without doubt, the time is not far distant when breeders of purebred sheep will find it necessary to have records of performance for the ewes in their flocks if they are to bring about continued improvement and sell breeding stock to the best advantage These records of performance should be a type that will measure the weight and quality of the progeny as well as the wool clip of the ewe Such records are important, for selecting ewes on the basis of appearance is a very inaccurate approach to determining which are of most value in a flock This is shown by work at Michigan State College, where records on individual ewes show that they differ markedly in gross income from lambs and fleeces In one year, this income per ewe ranged from a low of $6 45 to a high of $18 18 This was true with ewes sired by the same ram and with ewes and lambs fed and cared for in a similar manner Ewes that seemed equally good according to show ring standards or in appearance and in a flock where ewes had been selected on this basis for nearly half a century showed such wide differences as previously indicated [19]

The form shown in Table 32 is used at Michigan State College and is suggestive of the type of record that flockowners should keep for each ewe in the flock Lambs from each ewe must be properly marked at birth and weighed at weaning time, and her fleece weighed and checked for quality The ewe whose record is shown was especially good from the standpoints of regularity of breeding, long life, weights of lambs at weaning, and grade of lambs produced

In determining what ewe lambs to keep for flock replacements,

[19] C L COLE Record of Performance in Sheep *Michigan Quarterly Bulletin* Agricultural Experiment Station Michigan State College East Lansing Mich. vol. 23 No 1 (August 1940) pp 6–8

TABLE 32. PERFORMANCE RECORD FOR A EWE

Ewe No —3114 Breed—Hampshire	Reg No —130876 Sire—Wheaton 31	Birth Date—4-10-32 Dam—321	Single_____ Twin__X__ Triplet_____

Year	Breeding		Date lambed	Lamb No	Sex	Birth		Weaning		Fleece		Disposal of lambs
	Ram	Date bred				Wt	Grade	Wt	Grade	Wt	Grade	Remarks
'33	M S C.									5 2	¼ Comb	
'34	3225		4-10-34	3607	R	9	1	81	1	7 9	¼ Comb	
				3608	R	9 3	1	75	1			
'35	U S D A 86185		3-30 35	3732	E	7 8	1	76	1	7 4	¼ Comb	
'36	U S D A 86185 86185		4-14-36	389	R	11 4	1	103	1	6 9	¼ Comb	
'37	U S D A 86185		4-1 37	3947	E	6 1	2	63	2	7 5	¼ Comb	
				3948	E	5 1	2	63	2			
				3949	R	9	1	73	1			
'38	U S D A 86185		4 8 38	8 81	R	10	1	55	2	8 3	⅜ Comb	
				8 82	E	9	1	67	1			
'39	B & D		4-5-39							6 8	¼ Comb	
				9-53	E	11 8	1	84	1			

consider in each case the performance record of the dam and the transmitting ability of the sire, as discussed on previous pages. Give preference to a ewe lamb from a ewe with a good performance record, sired by a ram that rates high in its progeny test. Of course, it is desirable that this ewe lamb be of approved type, but the other considerations are highly important. In selecting ewe lambs, give attention to the twinning characteristic, as continued selection for twinning is likely to increase the number of twins in succeeding generations.

By keeping a record of offspring from various ewes in a flock, it is often possible to find families that are especially prepotent with respect to desired type, rapidity of growth of lambs, pounds of lamb per ewe, and weight and quality of fleeces. For flock replacements, retain ewe lambs fiom these families.

Developing a Grade Flock of Sheep. Owners of nondescript or common ewes can bring about marked improvement through the use of purebred rams, especially for the first two or three generations. The value of using a purebred ram with such a flock as contrasted with the continued use of a scrub ram was demonstrated by an experiment at the Kentucky Experiment Station. When a scrub ram was mated with ewes of the sort indicated above, the lambs weighed only 56 lb. at four months of age. Similar ewes mated to purebred rams produced grade lambs that weighed 72 lb. at four months of age and sold for $1 per hundred more than the scrub lambs. (All ewes and their lambs were fed alike) The fleeces produced by the common ewes averaged only 5 lb. in weight, while the fleeces of the first-cross grades averaged 7.5 lb. and much of the wool of the latter group was finer and more uniform.[20]

By continued use of purebred sires for generation after generation and the selection of grade ewes in each generation for flock replacements, a breeding flock of high-grade ewes can be built up in a few years. After the first one or two crosses with purebred rams, more and more attention must be given to the careful selection of rams and to the selection of ewes that are retained in the flock. Otherwise, improvement in such characteristics as pounds of lamb produced per ewe and weight of fleece (or a combination of these in terms of production credit per ewe) is likely to level off instead of showing continued progress.

In improving range flocks, the so-called "touch system" has been developed to select the ewes with the best fleeces. This method consists of grasping wool, on the back of each ewe, to determine its comparative length, density, and quality. These characteristics of the fleece are considered along with smoothness and type of the individual ewe. By confining the ewes in special corrals and driving them into chutes, an experienced operator with assistants can handle the individual ewes rapidly and thus determine which ones to keep and which

[20] L. J Horlacher and Carsie Hammonds, "Sheep," pp 104–105, The Interstate, Danville, Ill, 1942

ones to cull By repeating this process each year, considerable improvement in flocks has resulted from the use of this method of selection

In some states, flockowners are aided in securing purebred rams of good quality by use of a "ram truck," usually sponsored by the college of agriculture in a given state, in cooperation with producers of purebred rams By this method, rams from various breeders are loaded into trucks and taken to various scheduled points in the state where purchasers can make their selection and thus secure well-bred rams for their flocks. Often, tried rams of proved merit are picked up at

FIG 216 A flock of ewes and their lambs owned by a student of vocational agriculture at Manchester, Ky The ewes are a part of a total of 10,000 crossbred western ewes purchased cooperatively during a 3 year period by Kentucky boys in vocational agriculture (*Watson Armstrong, Kentucky*)

various points for resale, and thus good mature rams are kept in circulation rather than sent to market

It is desirable for each owner of a grade flock to set up some simple system of records for individual ewes, as discussed earlier in this chapter (see page 379).

Identify each ewe and her lambs by an eartag system or by a system of ear notching. This is necessary in connection with simple records on the pounds of lamb produced by each ewe in a given period of time as well as the weight and quality of fleeces produced each year, as mentioned above.

In sheep improvement on the ranges, experiments at the U S Sheep

Experiment Station at Dubois, Idaho, show that it is important to select open-faced ewes and rams, as indicated in Chap. 2. Open-faced ewes produce as much or more wool and more pounds of lamb than those that are wool-blind or partly so from too much wool around their eyes. Wool-blind lambs are usually "at the thin end of the cut" at marketing time and have to be sold as feeders. By mating open-faced rams with open-faced ewes, it has been found that about half the lambs are open-faced and about half have partly covered faces. By

FIG. 217. A range-bred Rambouillet ram showing ruggedness, freedom from wrinkles or folds in the skin, and a face not covered with wool. Such rams are desired for use in improving range flocks. (*Western Sheep Breeding Laboratory, Dubois, Idaho. U.S. Department of Agriculture.*)

continued use of open-faced rams and further selection among the ewes in successive generations the open-faced characteristic can be established in a flock.

As a further consideration in flock improvement in the fine-wool breeds, some attention is being given to develop individuals free from skin folds or wrinkles on their bodies. Such sheep produce as much or more clean wool than the wrinkled sheep, and the wool is longer and more uniform. Smooth sheep are easier to shear than wrinkled ones. (See Fig. 217.)

In many parts of the range country, as much as two-thirds of the

income is from lambs and one-third from wool. Consequently, in flock improvement, attention must be given to the selection of rams that are capable of transmitting size, weight, fleshing, and fast-gaining qualities to their offspring, as well as fineness, length, and density of wool. Open-facedness and freedom from wrinkling are other qualities desired as mentioned above.

The practice of progeny testing for rams is likely to increase on both farm and range. As yearlings, the most promising rams are mated to a few ewes and the resulting lambs are checked as to rapidity of growth, uniformity of type, fleshing, ruggedness, fleece, smoothness or freedom from wrinkles, open-facedness, and other desirable characteristics. Rams that have high-class offspring are retained for further matings.

Crossbreeding for Producing Market Sheep. In some sections, crossbreeding of sheep for producing market lambs has been used with considerable success. Work at the various agricultural experiment stations and by the U.S. Bureau of Animal Industry indicates that crossbred lambs frequently are more vigorous, grow and mature more rapidly, and hence reach market weight at an earlier age than grades or purebreds. Many range sheepmen are retaining crossbred ewes for their breeding flocks. No doubt, crossbreeding will be used more widely in the future for the production of market lambs. In crossbreeding for the production of market lambs, the results have been especially favorable from using rams of the larger breeds, such as Hampshires and Suffolks. As discussed in Chap. 2, some new breeds of sheep that are especially suited for range conditions have been developed through crossbreeding followed by careful selection.

6. Breeding and Improving Goats

Improving Milk Goats. The improvement of milk goats will come about through selecting and mating animals that have the ability to transmit good milk production. As in other kinds of livestock, outward appearances of animals are deceiving in determining the ability to produce and the ability to transmit good production.

Base the choice of females largely on records of individual performance and on the performance of progeny of these does. Select bucks from high-producing dams and from sires which have proved their ability to transmit good production to their offspring. Also, study the pedigrees to note evidences of good performance and transmitting ability in recent generations.

Improving Angora Goats. Breeders of Angora goats seek to improve the quality and quantity of fiber. Select herd bucks with fine fleeces, free from coarse, straight, stiff hair (kemp). Similarly, select breeding does with good-quality fleeces. Cull ewes on the basis of fleeces they produce and on the basis of kinds of fleeces produced by their offspring. Wherever possible, select bucks which have proved their ability to sire offspring with good fleeces. Select breeding stock which is rugged and sturdy.

7. Breeding and Improving Horses and Mules

Many farmers are interested in raising horses or mules as replacements for work stock on their own farms or for sale to other farmers.

Horses and mules reach their peak of value on the market at around

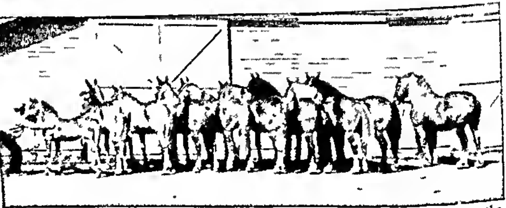

FIG 218 A stallion and one representative offspring for each of 9 years Note the uniform excellence of his progeny, showing prepotency, or ability to transmit his own characteristics to his colts (*U.S. Department of Agriculture*)

five to eight years of age After that, their market value gradually decreases. Consequently, some farmers plan to produce enough colts for replacements so that they can dispose of their work stock at the age when prices are most favorable.

Improving Work Stock. The true value of an animal as a work horse is how well it does the job that is expected of it. Strength and endurance are necessary in most types of farm work, although a fair degree of speed is also desirable in many cases Mares and stallions that are consistent in transmitting these characteristics to their offspring are the kind desired for breeding stock.

At present, the tendency is to breed toward medium-sized work

horses with a mature weight of around 1,600 lb. or less. In securing this kind of offspring, medium-sized mares bred to purebred stallions are likely to prove most successful. Rapid-growing colts should weigh around 800 to 900 lb. at one year of age, 1,200 lb. at two years, and 1,400 lb. at three years and should reach maturity at about five years of age. It is possible to start with rather inferior mares and by mating them with good purebred stallions bring about marked improvements in the offspring in two or three generations. As with other kinds of livestock, the merit of males and females of breeding stock is best shown by their progeny (see Fig. 218). In the production of mules, good results can be obtained by mating good grade mares to jacks of good quality.

In some communities, in order to secure superior stallions or jacks, farmers purchase them cooperatively. In some of these organizations, each farmer wishing to join purchases a share that entitles him to breed a specified number of mares. Expenses for the care and feeding of the stallion or jack are borne jointly by the members.

Improving Light Horses. Light horses are kept for various purposes. Breeders seek to improve them in accordance with the desired purpose or use. In horses for racing, speed is of greatest importance. In saddle horses and light harness horses, beauty and graceful action are desired. In cow horses and polo ponies, quickness and courage are needed. The real test of the usefulness of the individual horse is its performance along the desired line. The potentialities for good performance are inherited; but training, feeding, and care are needed to develop the inherited qualities.

While performance will help in selecting superior individuals, the ability to transmit these qualities to their offspring differs with individuals. A study of the pedigrees of superior performers aids in predicting the likelihood that their offspring will be good. If close ancestors of a mare or stallion have been good performers and have consistently produced good performers, the mare or stallion is more likely to produce good offspring. This likelihood is increased if the full brothers and sisters of the individual under consideration are consistently good performers.

The progeny of a given mare or stallion provide the best basis for determining the value of the individual for breeding purposes. These parent animals that are thus proved superior are the most valuable for improving light horses.

SUPPLEMENTARY ACTIVITIES

1 With others in your class, visit farms where good breeding programs have been carried on that have resulted in improved herds or flocks Confer with the person in charge, and note evidences that certain sires and dams have transmitted desired characteristics to their offspring For example, study the daughters of a sire and the records that indicate their productivity Do likewise for the daughters of some family that started with a certain female What are some of the practices you feel were most important in herd improvement?

2 A stockyard bull of inferior breeding was placed with a farmer at no cost to the farmer This was done with the understanding that when this sire became two years old he would be replaced with another bull A checkup several years later showed that 10 daughters of this bull averaged 40 lb less than their mothers Figuring butterfat at 80 cents per pound, how much did this bull "cost" the farmer in 1 year when these daughters were in production?

3 In your own projects, after one or more generations have increased the number of livestock to the extent that some must be sold, make plans for selecting the females that you wish to keep for breeding stock What factors will you consider? After making these plans, carry out the job of selection at the appropriate time

4 Make plans for aiding your father in selecting the females in the herd or flock with which you are cooperating as an improvement project or on a partnership basis What factors will you consider in making these selections? Assist him at the appropriate time for making these selections

5 For your livestock projects, make plans for securing the services of desirable sires What factors will you consider? Follow out the plans in providing a sire.

6 With your father, make plans for securing a sire for the herd or flock in which you are cooperating as an improvement or partnership project Assist him in making the selection

7 With other students in your class make plans for purchasing a sire cooperatively for use in your projects What factors will you consider in selecting such a sire? How will you finance the purchase? How will you provide for his care? After plans have been carefully made, select a committee to work with your teacher in selecting such a sire

8 After one cycle of production in a project of your own or in an improvement or partnership project with your father, set an appropriate goal of productive efficiency for the coming year Make plans for achieving this goal, and proceed to carry them out.

9 After studying Chap 8, develop an appropriate system of records

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for measuring the efficiency in your herd or flock, and thus check on the extent to which your goals as set were really achieved.

10. After one or more years of record keeping on your home dairy herd, make all possible daughter-dam comparisons for proving the sire in use in your herd. What do you conclude as to his worth?

11. Study families of cows in your home herd to find lines that trace to single cows that were especially prepotent. Do the same for other kinds of livestock on your home farm.

12. If artificial insemination is being practiced in your community, study the methods in use. Consider the possibility of using these sires for your projects; if it seems desirable, make the necessary arrangements.

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8. Keeping and Using Livestock Records

FOR THE livestock producer who seeks to improve his herds and flocks records are essential A system of records should be developed that is not too complicated and yet gives the necessary information about animals in each enterprise To be of real value, records must be kept accurately and then interpreted and used in an effective manner Procedures for doing this are discussed under the following activities

1 Planning and Developing a System of Livestock Records
2 Keeping and Using Records for Hogs
3 Keeping and Using Records for Dairy Cattle
4 Keeping and Using Records for Beef Cattle
5 Keeping and Using Records for Sheep

1 Planning and Developing a System of Livestock Records

Some of the desirable types of records and their importance are discussed in the paragraphs which follow They include (1) breeding records (2) production records (3) feed records and (4) financial records Specific methods of keeping and using these records for each kind of livestock are discussed in later portions of this chapter

Planning Breeding Records Breeding records should include information on the identification of each breeding animal in the herd or flock dates when females are bred service sires used dates when offspring are expected actual dates when offspring are born number of offspring identification of offspring and information about the disposal of animals from the herd

Careful records of dates of breeding make it possible to compute the approximate dates when offspring will be born Such information makes it possible to control feeding and other practices in ways favorable to the female as pregnancy advances and also to make special

preparations for the arrival of the young Attention to these matters aids materially in reducing the loss of young at the time of birth, when many losses are likely to occur

Information on birth dates of animals and on the name and registration number of each parent is necessary for securing pedigrees from registry associations

From properly kept breeding records, check up on such matters as calving efficiency, lambing percentage, number of services per preg

FIG 219 Proper records are important in improving herds and flocks This student of vocational agriculture in North Carolina is making entries in a record book for his livestock projects (*J K Coggin North Carolina*)

nancy, and similar items that reveal the breeding efficiency of a herd or flock, as described in Chap 7

Records of sales of animals, including persons to whom they are sold, date of sale, and price, are valuable in following up certain sales and giving advice to breeders when they return to make further purchases

Planning Production Records Records of production provide data for checking, in terms of the products secured, on the efficiency of each livestock enterprise and on individual animals within each enterprise

As described in Chaps 2 and 7, production records for sows include number of pigs farrowed and raised, and weights of pigs and litters at fifty six days and perhaps at some later age Production records for dairy cows include yearly milk and butterfat records for each cow With beef cattle, rate of gain is an important index of efficiency With sheep the weight of fleece and number and weights of lambs are important in determining which females to retain and which ones to sell Such records are valuable for selecting animals in herds or flocks Through proper use of records on parent animals and offspring it is also possible to check on the transmitting ability of sires and dams

Planning Feed Records In raising livestock and in fattening animals for market, it is desirable to have records of the feed consumed Such information for dairy cows along with production and financial records aids in checking the returns above feed costs for each cow Information on feed consumption is also valuable in checking feeding operations with animals being fattened for market The amount of feed required for 100 lb of gain or per pound of gain is helpful in determining a person s efficiency as a livestock breeder

In making plans to raise a given kind of livestock, increase the number to be raised or change to some other enterprise, it is frequently necessary to compute the amounts of feeds that will be required In Table 5 (page 125) figures are given on the approximate feed requirements for each kind of livestock By using these figures it is possible to determine the required amounts of various feeds This is an aid in making decisions on production problems and in gearing the cropping program to the livestock program on a given farm Data from past feed records kept on specific kinds of livestock can be used to advantage for the same purpose

Planning Financial Records Different kinds of financial records may be kept for livestock These may include cost accounts for the entire farm or separate enterprise accounts for each kind of livestock Particular attention in this chapter as far as cost accounts are concerned is given to separate accounts for each livestock enterprise Cost accounts for each livestock enterprise are of two general types One type provides information for rather simple *financial summaries* which show such results as net profit or loss and labor income to the person operating the enterprise The other type somewhat more detailed provides data for making a ***cost of production summary*** and an analysis of costs per unit of production

Financial Summary. For the financial summary, keep records that provide for the following items:

1. Receipts or credits:
   a. Value of products sold or used at home.
   b. Miscellaneous credits not included above (see explanation following this summary).
   c. Total closing inventory (see explanation following this summary).
   d. Total receipts or credits (the sum of items *a, b,* and *c*).
2. Expenses or debits:
   a. Total charges for labor (including self-labor and other unpaid labor, as well as paid man labor and machine and horse labor).
   b. Total charges for supplies (feed, bedding, etc.).
   c. Overhead and miscellaneous charges (see explanation following this summary).
   d. Total opening inventory and additional investment during the year (see explanation following this summary).
   e. Total expenses or debits (the sum of *a, b, c,* and *d*).
3. Total net profit or loss (subtract 2 from 1).
4. Value of self-labor.
5. Labor income from enterprise (add 3 and 4).

Include foundation animals in the opening inventory. Make a direct charge or rental value for the use of the buildings and equipment under miscellaneous charges. In the closing inventory include all feed, supplies, foundation stock, animal products, and animals raised which are still on hand when the account is closed.

Miscellaneous credits is an item under receipts or credits in the financial summary and an item of deductible credit in the cost-of-production summary. This item includes rebates (such as patronage dividends for feed purchased from a cooperative); value of manure; service fees collected from outside use of sires owned by the person operating the enterprise; and any other similar credits not resulting from the sale or home use of the main product.

Overhead and miscellaneous charges include such items as rent or charge for use of land and for use of buildings and equipment not inventoried; interest on investment; trucking and other transportation costs; fees for services (veterinary, registration, breeding); insurance; commission charges; and all purchases of the main product (such as pigs and calves) while the project is in progress.

Cost-of-production Summary. For developing a cost account that

provides data for a cost of production summary in terms of cost per 100 lb of pork cost per animal etc, the following is suggested

1 Summary of total costs
   a Value of supplies actually used by the animals (including feed, bedding etc)
   b Charges for labor (see similar item in financial summary)
   c Depreciation (decreased inventory on foundation stock and equipment inventoried)
   d Overhead and miscellaneous charges (see similar item in financial summary)
   e Total costs (the sum of *a* *b*, *c*, and *d*)
2. Summary of deductible credits
   a Miscellaneous credits (see similar item in financial summary)
   b Appreciation (gain in inventory on foundation stock and on equipment if inventoried)
3 Total cost of production (subtract 2 from 1)
4 Total production not including foundation animals (in pounds of pork number of head pounds of butterfat etc)
5 Cost of production per unit (divide 3 by 4)

In keeping cost accounts on livestock projects in vocational agriculture special forms are usually provided or recommended within each state Forms for enterprise cost accounts are also available through the college of agriculture in each state Some students in vocational agriculture, under the direction of their instructor, find it desirable to make their own record books by following such suggestions as those offered in this chapter (see also the Appendix)

Making Budgets. Before starting to raise livestock or undertaking a new cycle of production, young stockmen find it desirable to make a *budget* or estimate of costs and returns Budgets are of value in deciding whether or not to raise a given kind of livestock, in making business arrangements with parents and others and in planning ahead for feed various supplies and equipment needed Forms for budgets differ but the purpose is to estimate carefully in advance the total expenses involved the actual cash needed, and the incomes expected Records of similar enterprises for previous years and other information from various sources are helpful in making these estimates, or budgets A suggested form for this purpose is shown in Table 33

Interpreting and Using Livestock Records Records are kept to use Unless the results are carefully interpreted and used to

improve the livestock programs and the individual livestock enterprises on a given farm, records are not worth the time required to keep them. Incidentally, the amount of time needed for keeping records has often been exaggerated. For example, many hog producers at Austin, Minn., have been keeping records on litter weights in sow testing for several years. This has been done in conjunction with adult-farmer classes under the department of vocational agriculture in the high school. These men found that only about 2 hr. per farm per year is required for marking litters and securing litter weights at fifty-six

FIG 220 A Michigan teacher of agriculture assists one of his students in making effective use of records in improving the student's livestock projects (*Michigan State Board of Control for Vocational Education*)

days. This is a small amount of time compared with the value of the records in improvement work

Records can be used as a basis for bringing about changes intelligently. They reveal certain weaknesses in enterprises and thus may lead to the adoption of practices for improving them Students of vocational agriculture at Olivet, Mich , through simple records found that the average number of pigs raised per litter in their sow-and-litter projects and other litters on their home farms was around 5 pigs Through the adoption of better practices, this was raised to 6.6 pigs per litter the following year and 7.4 pigs the third year.

Among the changes reported by one group of livestock producers as

TABLE 33 FORM FOR BUDGETS, OR ESTIMATES, OF EXPENSES AND RETURNS BEFORE STARTING A LIVESTOCK PROJECT, WITH SPACE FOR RECORDING ACTUAL AMOUNTS AT END OF PROJECT YEAR*

Expense items	Estimated expenses				Actual expenses			
	Amount	Unit price	Cost		Amount	Unit price	Cost	
Original animals								
Feeds required								
Labor and power								
Fixed charges								
Rent								
Buildings and Equipment								
Interest on operating capital								
Miscellaneous								
Estimated Total Expenses	XX	XX			XX	XX	XX	XX
Actual Total Expenses	XX	XX	XX	XX	XX	XX		

Return items	Estimated returns				Actual returns			
	Amount	Unit price	Value		Amount	Unit price	Value	
Closing inventory								
Value of animals sold								
Val. of produce (wool, milk etc.)								
Miscellaneous credits								
Estimated total returns	XX	XX			XX	XX	XX	XX
Actual total returns	XX	XX	XX	XX	XX	XX		
Estimated profit		$						
Actual total profit					$			

* Adapted from "Record Book," for students of vocational agriculture in Iowa, published by The Interstate, Danville, Ill.

the result of keeping livestock records were the following: (1) changed to kinds of livestock that better utilized feed, labor, buildings, and markets; (2) took better care of livestock; (3) changed feeding practices; (4) had hogs ready for market during months of high prices; (5) used labor more efficiently; (6) used buildings to capacity; (7) increased the production of herds and flocks.

Some livestock raisers find it challenging to set goals for their herds and flocks, as discussed in Chap. 7. One dairyman set 400 lb. of butterfat as a yearly average for the cows in his dairy herd. By keeping records of production on individual cows and using the results intelligently, he was able to improve the herd and to measure progress toward his goal. While it took several years to reach it, his interest was maintained by the fact that his records showed that he was making progress. He developed a certain degree of satisfaction in his efforts, and he naturally felt a justifiable pride in his accomplishments when the goal was reached. Thus, records take the guesswork out of livestock production; if rightly used and interpreted, they are a valuable aid in livestock improvement.

Data from livestock records kept by several breeders can be used for computing averages and other measures by which an individual farmer can check progress in his own livestock enterprises, as discussed in Chap. 7 and in later portions of this chapter.

2. Keeping and Using Records for Hogs

For breeding herds, it is important to keep breeding and production records for the sows. Feed and financial records are desirable for breeding herds and also for stock being fattened for market. Some suggested types of records and methods of keeping them are described on the following pages.

Keeping Breeding Records. Provide and keep a breeding record on each sow. The record can be in the form of a card file for each sow, or it can be included in a herd book especially designed for this purpose. The information usually desired includes the date of breeding, name of service boar, date due to farrow, date of farrowing, number of pigs farrowed, number of pigs raised, and the identification mark used for the pigs or litter. A suggested form for recording this information on each brood sow is shown in Table 34. This form is usable for either grade or purebred sows.

TABLE 34 BREEDING RECORD FOR BROOD SOW

Name of brood sow________ No.________ Date of birth________

Bred by________ Address________

Pigs in litter________ Boars________ Sows________ Raised________

Purchased from________ Date________ Price________

Litter no.	Bred			Farrowed				Weaned				Wt. of litter at 56 days	Remarks§
	Date	Service boar	Due*	Date	Boars	Sows	Dead	Date	Boars	Sows	Litter mark†		
1													
2													
3													
4													

* See gestation table page 339

† See Chap 5 for suggested methods of marking for identification.

§ For comments on uniformity of litter and other information of value in selecting future breeding stock

Hog breeders who sell considerable breeding stock find it helpful to keep a record of sales to individual breeders, as these aid in making out pedigrees and advising the breeder on other purchases A suggested form is shown in Table 35

TABLE 35 HOG SALES RECORD

Date	Name and registration no of animal	Sex	Sold to	Address	Price	Remarks

Some swine registry associations have developed herd books for recording some of the types of data indicated in the preceding tables Each registry association has forms that must be filled out in applying for registration and securing a pedigree The registry association also provides forms for applying for transfers of pedigrees for purebred

animals of that breed in the case of sales. It is the responsibility of the seller of a purebred animal to apply for transfer of ownership on the books of the registry association and to secure a transfer certificate and deliver it to the buyer with the pedigree.

Keeping Production, or Performance, Records. As suggested in Chap. 7, litter weights and other information at the time the pigs are fifty-six days of age are being collected and used by increasing numbers of swine breeders. This information is useful in checking the ability of individual sows to produce, or for "sow testing" as it is called. This information can be included in the form for the breeding record, or a separate form can be used. The form in Table 36 is suggested for this purpose.

TABLE 36. HOG PRODUCTION RECORD

Herd owner______________________

Name and no of sow and identification	Name and no. of sire of litter	Date farrowed	No. of pigs farrowed	Information at 56 days*					
				Actual age when weighed	No. of pigs	Wt. of litter	Av wt per pig	Lightest pig	Heaviest pig

* If weights are not made on the fifty-sixth day, the weights can be adjusted as shown in Table 37.

If there are several litters of about the same age in a herd, it may be more convenient to weigh all of them on the same day. Sometimes, also, in the case of a single litter, it is not possible to secure the weights on exactly the fifty-sixth day. In such cases, it is possible to change the weights to a fifty-six-day basis by using appropriate factors obtained from those shown in Table 37.

Keeping Feed Records. It is desirable to keep a record of feed consumption on hogs so that fairly accurate averages can be made in terms of feed requirements per 100 lb. (or per pound) of gain. In keeping these records for a separate litter or for a larger herd, the easiest method is to use feed from bins in which the amounts of feed are

TABLE 37 FACTORS FOR ADJUSTING LITTER WEIGHTS TO 56-DAY BASIS

AGE OF LITTER DAYS	FACTOR
51	1 14
52	1 11
53	1 08
54	1 05
55	1 02
56	1 00
57	0 98
58	0 95
59	0 93
60	0 91
61	0 89

Example Litter weight at 60 days is 255 lb
0 91 × 255 = 232 1 lb which is weight of litter changed to a 56-day basis

checked at the time of filling If a self-feeder is used, check the amounts and kinds of feed placed in the feeder each time it is filled If mixtures of feed are made up, such as a mixture of protein feeds, make a record of the total amount of each mix and compute the amount of each separate ingredient from the proportion of it in the mixture If the bushel basket method or some other measure is used in daily feeding check on feed consumption at intervals of every few days and from these sample days compute the total amount for a period of a week or more

For feed records, keep a small notebook in a convenient place in the hog house or feed storage building Record amounts of feed systematically according to the method used

Keeping Financial Records. Before starting a hog project, make a budget, or estimate, of costs and returns on the proposed undertaking A suggested form suitable for this is shown in Table 33

Cost accounts for a swine breeding enterprise should show accurately the various costs and the sources of income For a simple *financial summary* to show net profit or loss and labor income, the types of information and method for computing as shown on page 391 are helpful

For a *cost of production summary* make the records sufficiently complete to include an analysis of costs for various periods, such as breeding to marketing, breeding to weaning, and weaning to marketing, if desired Suggested forms of this type for summarizing the records of

sow-and-litter projects are shown in Table 53 in Appendix I. These forms are also suggestive for computing various measures of efficiency, such as pounds of feed per 100 lb. of pork and feed cost per 100 lb. and per pig.

In the case of a pig-feeding project where the pigs are purchased as feeder stock and fattened for market, a simple type of record may be desirable. Suggestions for a summary for such a record are shown in Table 54 in Appendix I.

Interpreting and Using Hog Records. After records have been made, use them as a basis for analyzing the efficiency with which a project or enterprise has been carried out. For example, a person may have secured a litter weight at fifty-six days of 240 lb. for a litter of six pigs. In comparison with other data for similar hog raisers who have been using improved methods, he finds this is about average. However, he finds that the number of pigs raised is considerably below the average of the group but that the average weight per pig in his litter is 40 lb., or among the top third. He concludes that in order to improve he needs, especially, to analyze the methods used at farrowing time to determine what practices might be adopted to increase the number of pigs saved. He also decides that he might find ways to increase somewhat the weight per pig at fifty-six days, as some hog raisers secure weights of well over 40 lb. per pig. Some of the information in Tables 16, 17, and 18 (pages 342, 344, and 345) should be helpful for purposes of comparison.

Analyzing Feed Records. Feed records serve as a good basis for analyzing one's efficiency as a hog raiser. If, for example, accurate records have been kept on feed consumed per litter from the time the sow was bred to the time the pigs were marketed and you know how many pounds of hogs were produced, you can determine the pounds of feed per 100 lb. of hogs produced.

To compute the pounds of hogs produced in a herd, proceed as follows: (1) determine the weight of hogs on hand at the end of the year when records are summarized; (2) add the weight of hogs sold; (3) subtract the weight of hogs at the beginning of the year; and (4) subtract the weight of hogs purchased. To determine the hundredweight produced, divide the number of pounds produced by 100. Then, to secure the concentrates required per hundredweight of hogs produced, divide the pounds of concentrates (grain and supplement) by the number of hundredweight of hogs produced.

TABLE 38 A COMPARISON OF REGULAR SOW AND LITTER PROJECTS, CANAL WINCHESTER, OHIO 1940*
Listed According to Total Cost per 100 Lb. of Pork

	Breeding to market period											Breeding weaning		Weaning to marketing		
Project no.	No. of litters	No. of pigs raised per litter	Lb. of pork produced per sow	Labor income per sow	Labor income per hr	Lb. of feed per lb. of pork produced	Returns per $1 worth of feed	Feed cost per 100 lb. of pork	Total cost per 100 lb. of pork	Av. selling price or inventory value per 100 lb. of pork	Hours of man labor per 100 lb. of pork	Total lb. of feed per litter	Feed cost per litter	Av. daily gain per pig	Lb. of feed per lb. of gain in period	Returns per $1 worth of feed in period
1	4	10.7	2,291	$37.51	$1.77	2.78	$1.77	$3.88	$4.21	$6.67	0.91	610	$8.45	1.1	3.3	$1.67
2	10	9	2,036	34.34	1.15	3.3	1.49	4.19	4.77	6.29	1.6	1,210	13.58	1.5	3.2	1.39
3	2	8.5	1,880	52.46	1.25	2.9	1.80	3.95	4.86	7.23	2.2	1,512	17.98	1.5	2.8	1.96
4	1	9	1,860	34.10	0.37	3.9	1.47	4.31	5.08	6.30	5.0	1,354	14.06	1.2	2.8	1.41
5	3	4.7	1,047	17.12	0.69	3.7	1.29	4.84	5.09	6.27	2.4	1,133	11.36	1.1	3.4	1.39
6	2	9	1,902	9.94	0.21	3.9	1.35	4.62	5.34	6.24	2.4	1,532	14.67	1.4	3.8	1.34
7	1	8	1,660	28.42	0.38	3.9	1.43	4.30	5.38	6.70	4.4	1,361	14.22	1.0	3.7	1.41
8	1	8	1,760	37.45	0.50	4.0	1.62	3.79	5.42	6.20	4.2	1,477	14.47	1.0	3.2	1.51
9	1	9	2,030	44.98	0.65	4.0	1.56	4.51	5.46	7.00	3.4	1,540	12.70	1.4	3.8	1.44
10	1	7	1,480	20.31	0.29	4.1	1.36	4.82	5.60	6.15	4.8	1,706	13.71	1.1	4.0	1.33
11	1	11	2,475	19.85	0.21	3.5	1.23	4.95	6.06	6.10	3.8	1,706	18.10	1.2	3.23	1.23
12	1	9	1,890	32.72	0.57	2.8	1.78	3.95	6.06	6.25	3.01	1,507	20.87	1.4	2.3	1.87
13	1	8	1,200	8.31	0.12	4.03	1.33	4.42	6.31	5.91	5.4	1,809	20.01	1.4	3.8	1.54
14	2	7.5	1,438	10.32	0.09	4.3	1.22	5.11	6.98	6.25	8.1	1,280	12.75	1.1	4.2	1.10
15	1	5	1,040	11.45	0.12	4.1	1.30	4.70	7.10	6.10	9.7	1,150	10.18	1.1	3.6	1.31
16	1	3	600	2.19	0.03	8.2	1.12	5.68	8.60	6.35	11	1,388	11.87	1.0	4.5	1.31
17	1	5	940	20.36	0.24	5.5	0.82	7.26	9.56	5.64	8.7	1,252	15.05	0.8	5.2	0.71
Av.	2	7.73	1,619	$15.33	$ .48	3.93	$1.40	$4.61	$5.99	$6.30	4.8	1,355	$14.36	1.2	3.6	$1.41

* Data from Ralph F. Bender, Ohio. NOTE. The financial parts of these records are computed on the price levels of 1940.

TABLE 39. SOME FACTORS INFLUENCING DIFFERENCES IN SOW-AND-LITTER PROJECTS, CANAL WINCHESTER, OHIO, 1940*

Project no	Breeding	Feeding	Sanitation	Marketing	Miscellaneous
1	A purebred Poland China sow, purebred Chester White sow, and two crossbred sows all bred to registered Poland China boar Sows were flushed	Self fed a ration 40 per cent Porkmaker and corn Hand fed ground wheat. Tankage added during gestation Red clover pasture Pigs fed in a creep	Two new houses Old ground Pigs were wormed Treated for cholera	Sold hogs to Columbus Producers from Sept 7 to Oct. 10 Average 221 lbs Gilt kept for breeding stock	Made an official ton litter. Pasture was very good
2	9 purebred Poland China sows and gilts and one Duroc Jersey sow bred to Poland boar Excellent type Sows were flushed	Hand fed corn and self fed soy bean-oil meal and tankage Pigs fed in a creep Bluegrass pasture	Houses cleaned thoroughly Sows' sides and udders brushed before farrowing	Sold hogs to local dealer Sept 25 Averaged 226 lb	An excellent job of feeding and management 10 tons of pork from 10 sows 6 official ton litters
3	One registered Duroc-Jersey gilt bred to registered boar and a grade Duroc bred to a Poland boar Sow and gilt flushed	Self fed shelled corn and a supplement of tankage and soybean-oil meal. Bluegrass pasture	Pigs kept on clean ground until 65 lb in weight	Sold 5 gilts and boar for breeding stock Market hogs sold to local dealer on Aug 18 Averaged 235 lb	Exhibited at county fair Produced an official ton litter
4	A Chester White gilt bred to a Chester White boar Gilt was flushed	Hand fed corn and skim milk Small amount of ground wheat used Clover pasture	Clean ground	Sold hogs to local dealer Oct. 23 Averaged 207 lb	Very good pasture Corn was somewhat limited
14	Two registered Berkshire sows bred to a registered Chester White boar Sows were flushed Good type sows	Self fed a ration of shelled corn, skim milk, and 40 per cent Porkmaker Hand fed during last month before marketing Bluegrass pasture, some clover and timothy	Scrubbed house and disinfected with creosote Old ground used	Sold to Carl C Meuser, a local dealer, on Oct. 28 5 used at home for meat	Pigs got a poor start. Feed cost per 100 lb of pork high. Pasture was good One deformed pig raised to 150 lb and was killed at that weight

* Data from Ralph E Bender, Ohio. NOTE Information shown in this table includes only part of litters represented in Table 38

TABLE 40. BARN BREEDING RECORD*

Cow	Service dates and sire			Date due	Date fresh	Sex	Identification	Special remarks
Daisy	Duke 7-14-43	Duke 8-4-43		5-13-44	5-15-44	F	Eartag #380	Kept for herd replacement

* Adapted from form by R. E. Horwood, Michigan State College, East Lansing, Mich.

As an example, one producer of six litters of pigs fed 62,040 lb. of grain and supplement to these pigs and the breeding herd. He produced 127.2 hundredweight of hogs during the year, computed as indicated above. By dividing 62,040 by 127.2, he found that approximately 488 lb. of feed were required per hundredweight of hogs produced. This figure is somewhat higher than that of the most efficient swine raisers. Upon analysis of his practices, this hog raiser decided that he had not fed enough protein to his hogs, with the result that more feed was required for each 100 lb. of hogs produced.

Analyzing Financial Records. After keeping financial records, analyze them carefully to determine possible weaknesses in the hog enterprise.

Table 38 shows a summary of the cost-of-production records of some sow-and-litter projects of students in vocational agriculture. In Table 39, some of the factors influencing the differences are also shown.

The data in Table 38 are organized in such a way as to show the importance of litter size in securing economical gains. By careful study of such information as this, anyone can determine how his results compare with those of the rest of his group and with his own record for the previous year.

Over-all Use of Hog Records. Through the careful analysis and interpretation of several kinds of records, including breeding records, production records, feed records, and financial records, a person is able to bring about improvements, select the best sows for rebreeding, select gilts from the best litters, and make more intelligent plans for the future. One of the important uses of records is comparing accomplishments from year to year to see whether or not improvement is taking place and, if not, to determine the causes and make changes in practices as needed.

3. Keeping and Using Records for Dairy Cattle

Some of the kinds of records desirable in connection with dairy cattle are (1) breeding and health records, (2) production records, (3) feed records, and (4) financial records. Suggestions for these are included on the pages that follow.

Keeping Breeding and Health Records. Start a breeding record for each cow in the dairy herd when she reaches breeding age, and continue this record as long as she remains in the herd. Such a record for each cow should include the name and identification of the cow, dates of breeding, names and numbers of service sires, dates due, dates of freshening, sex and identification of offspring, and disposal of offspring if sold. Such records provide sufficient information for registering animals with breed registry associations in the case of purebreds, although similar information is desirable on all herds, regardless of whether or not registration is carried on. Records of this kind are really basic for all herd improvement.

In securing information for these records, many breeders prefer to have a wall chart or a notebook in the stable where breeding dates, calving dates, etc., can be recorded. These items are then transferred periodically to the breeding records of the individual cows, which are usually kept in a book in the house. For this purpose, some dairymen

find it desirable to keep a barn breeding record, one type of which is shown in Table 40 From this, information can be transferred to a permanent record for each cow, such as the one shown in Table 41, or to the breeding record attached to the production record as shown in Table 44

TABLE 41 BREEDING RECORD

Name of cow__________ Identification or registration no __________
Date of birth of cow__________ Breeder__________
Sire of cow__________ Registration no.__________

Date bred	Name and no of service sire	Date due	Date of calving	Calf		
				Sex	Eartag no	Remarks*

* If calf is sold indicate reason purchaser etc.

A health record is desirable in addition to a breeding record The health record should include information about tests for tuberculosis, Bang's disease, mastitis, etc The form in Table 42 is suggestive for a health record, which may be included on the back of the breeding record or on the same side of the sheet

Keeping Production Records As emphasized in Chap 7, in order to make consistent progress in herd improvement, keep production records for each cow in the herd These records should be of a type that if properly kept, will show the annual production of milk and butterfat for each cow of producing age Other information is frequently recorded, such as amount and cost of feed

Records of production are of value in (1) determining the good and poor producers, (2) feeding properly in accordance with production, (3) detecting abnormal conditions that may arise, and (4) checking on the transmitting ability of cows and sires

In keeping production records and other records for individual cows, some system of identification is necessary, as described in Chap. 5. For dairy cattle, the most common method is the use of eartags of the type recommended by the U.S. Department of Agriculture, Bureau of Dairy Industry, and used in D.H.I.A.'s.

TABLE 42 HEALTH RECORD*

Name of cow________________ Identification or registration no.________________

Tests						Immunizations				Sickness, injuries, etc		
Bang's		T B		Mastitis		Bang's		Mastitis				
Date	+ or −	Date	+ or −	Date	+ or −	Date	Remarks	Date	Remarks	Date	Ailment	Treatment

*Adapted from form by R. E. Horwood, Michigan State College, East Lansing, Mich.

The most common method of ascertaining the annual milk and butterfat production for each cow is to secure certain information for a "typical" day of each month. The milk produced by each cow for that day is weighed, and samples are taken at each milking. The samples for each cow are placed in one bottle and tested for butterfat. From this information, the production for each cow for that month is computed. This process is repeated monthly, the cumulative records over a 12-month period indicating the production records for a year. If properly carried out, this method has been found to be at least 95 per cent accurate as compared with daily weighings and computations, which would be so time-consuming as to be impractical under most conditions.

For keeping these production records, the necessary equipment includes a milk scale, sample bottles, record forms, sample dipper, and a Babcock tester, together with the glassware and acid needed for testing

provide lodging for a tester 1 day a month. However, the farmer does not receive as much advice and supervision as under the D.H.I.A. plan, and the records are not given official recognition.

3. *Mail-order testing.* This method is another form of the owner-sampler method, similar to that of the central testing laboratory, except that samples taken by the individual farmer are sent by parcel post to the college of agriculture in his state or to a central testing laboratory located elsewhere. In many cases this method has not been highly successful owing to lack of direct contact by a fieldman with the farmer

FIG 222 Students of vocational agriculture in many high schools test cows regularly and keep production records on their home dairy herds. (*W. A. Tulloch, Michigan.*)

and the resulting tendency for some farmers to be irregular in sending in their samples.

4. *Individual farmers.* In some cases, individual farmers keep their own records of production by the cows in their herds. This method has not proved very satisfactory, as the farmer frequently fails to make the monthly checkup because of the press of other work.

5. *Students of vocational agriculture.* Many students enrolled in departments of vocational agriculture in high schools are keeping dairy production records on their home-farm or nearby herds. This is being done very successfully in many departments, and the experiences have a high educational value to the boys who participate. In some cases the boys in these departments have organized junior D H.I.A.'s affiliated

TABLE 43. DAIRY WORK SHEET*

Name of owner______________________________Date______________________

Cow eartag and name	Night's and morning's milk	Total of day's milk	Month's milk	Per cent test	Lb. of butterfat for month	Daily and monthly feed amounts				
Total										
Average										

* Adapted from form developed by G. P. Deyoe and A. C. Baltzer, Michigan State College, East Lansing, Mich. This sheet is used for recording information at the farm, on the testing day of each month, and for the monthly amounts, before transferring to forms of the type shown in Table 44.

TABLE 44. YEARLY PRODUCTION RECORD BY MONTHS FOR INDIVIDUAL COW*

Cow's name______ Eartag or reg no.______ Breed______
Sire of cow______ Dam of cow______
Age at beginning of testing period______ Date fresh before testing year______
Weight______ (Can be estimated from heart-girth measurement)

Testing period	Testing day	No of days milked in testing period	Pounds milk daily†	Yield during testing period: Pounds of milk‡	Yield during testing period: Per cent test	Yield during testing period: Pounds of butterfat†	Remarks (date fresh, date dry, disease or other special conditions affecting production, date sold and reason)
Month of							
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total to date	xx		xx		xx		
Month of							
Total for year	xx		xx		xx		

Breeding Record

Date bred	Name and number of bull used

Record of Calves Born during Year

Date of birth			
Sire			
Sex			
Raised or sold			
Reason for selling			
Selling price			
Eartag no (if raised)			

Previous Yearly Records

Age, years	Days in production	Pounds of milk	Pounds of butterfat

* From form developed by G P Deyoe and A C Baltzer Michigan State College, East Lansing, Mich.
† Compute to nearest 0 1 lb
‡ Compute to nearest whole pound.

with the local chapters of the F.F.A. In most cases, the records kept by these boys are somewhat simplified, such as those shown on the forms reproduced in Tables 43 and 44. The value of this work in herd improvement is indicated by the improvements brought about by the department of vocational agriculture at Oshkosh, Wis., shown in Table 47.

Keeping Feed Records. In the regular records kept by D.H.I.A.'s, feed records are included. It is quite easy to determine the grain allowance for each cow on the day of each month when milk weights and samples are secured. The silage can be weighed in a basket or pail. The weight of the hay allowance can be secured by removing from the manger the amount of hay given to a cow, tying this hay with a small rope, and suspending the quantity of hay from a milk scale. From these figures, the monthly amounts of feed can be computed.

Suggestions given on page 397 in connection with feed records for hogs should be helpful in keeping feed records for dairy heifers.

Keeping Financial Records. For the herds of dairy cattle in the ordinary D.H.I.A, records of amounts and costs of feed, value of product, and income over feed costs are computed for each cow. Usually, for such herds, this is the extent of the financial records. Some herd owners will wish to keep complete cost accounts. For such purposes the summary in Table 45 is suggestive of the items to include under charges and under credits, as well as the computations of value to the herd owner.

Interpreting and Using Dairy Records. The primary value in keeping records on a dairy herd is to aid in determining the strengths and weaknesses of the herd so that improvements can be made. "Progress charts" of the type shown in Table 46 are helpful in interpreting records from month to month and indicating progress toward a goal previously set.

Records of production for a year on individual cows aid in determining which cows to cull and which ones to keep. Give proper consideration to the age of the animal, as cows do not reach their maximum production until they are five or six years old. Also, consider such factors as calving interval, length of dry period, and special conditions for which the cow "can't be blamed."

In Table 47, data are given that provide an example of steady improvement in the dairy herds as a result of the continuous use of in-

TABLE 45 DAIRY COSTS AND RETURNS IN MICHIGAN*
Based on 499 Records

Item	Per cow	Per 100 lb milk	Per lb butterfat
Butterfat production in year, lb	339		
Milk production in year, lb	7,809		
Feed consumption in year			
Concentrates, lb	2,167	27 8	6 4
Hay, lb	3,142	40 2	9 3
Silage, lb	4 850	62 1	14 3
Other roughages, lb	635	8 1	1 9
Pasture days	166	2 1	0 5
Man hours in year	154	2 0	0 5
Charges for year			
Feed	$57 43	$0 74	16 9 cents
Man labor at hired rates	29 10	0 37	8 6
Buildings and equipment use	9 49	0 12	2 8
Depreciation in cows	7 05	0 09	2 1
Interest on cow investment	4 63	0 06	1 4
Bull expense	4 01	0 05	1 2
Management	14 00	0 18	4 1
Other items	14 18	0 18	4 2
Total charges at farm	$139 89	$1 79	41 3 cents
Credits for year			
Dairy products sold and used	116 55	1 49	34 4
Manure	11 58	0 15	3 4
Calf at 5 days age	5 74	0 07	1 7
Total credits at farm	$133 87	$1 71	39 5 cents
Net return for year	−6 02	−0 08	−1 8 cents
Labor and management return per cow	$37 08		
Labor and management return per hour	0 24		
Net cost of milk and butterfat at farm	122 57	$1 57	36 2 cents

* From *Special Bull* t n 297 M ch gan S a e College Fast Lans ng M ch 1932 1936

formation secured These records were kept by students in vocational agriculture at Oshkosh, Wis Herds that were improved over a period of 3 or 4 years averaged 309 5 lb The best one third of these herds averaged 311 5 lb of butterfat after the first year of improvement For the herds in which improvement work was carried on for 3 or 4 years, the average production was 358 lb

In deciding which cows to cull, a person will wish to consider the present level of production in the herd In a herd in which the average annual production is 250 lb of butterfat per cow, he may

TABLE 46 PROGRESS CHARTS FOR HERD AVERAGES

Pounds of butterfat	Monthly averages for butterfat*											
40												
30												
20												
10												
Months												

* This chart should be used for graphing the month by-month butterfat averages for the herd

Pounds of butterfat	Butterfat averages shown cumulatively month by month*											
375												
350												
325												
300												
275												
250												
225												
200												
175												
150												
125												
100												
75												
50												
25												
0												
Months												

* This chart is intended for graphing averages cumulatively, month by month (The months can be written below the columns) If the herd owner and tester set a production goal for the year, this goal can be shown at the appropriate place on the right hand side of the table NOTE The yearly cumulative average will not agree exactly with the *actual* average computed after testing year closes, because allowances are not included in the former for cows freshening or drying off between testing dates.

TABLE 47. INCREASES IN PRODUCTION IN DAIRY HERDS IN SUCCESSIVE YEARS OF KEEPING PRODUCTION RECORDS*

No. of years of improvement work	No. of herds	Butterfat production, lb.		
		Average of all herds	Best herd	Best one-third of herds
1	42	242.0	357.0	311.5
2	30	273.5	398.0	333.0
3 or 4	43	309.5	411.0	358.0

* Data from J. I. Wilkinson, Oshkosh, Wis.

wish to keep cows having a production of 200 lb. or more, whereas the owner of a herd with an average of 300 lb. might wish to dispose of most or all cows producing below 225 lb. As previously mentioned, it is necessary to take into consideration the age of the animals and other factors. Furthermore, cows that are borderline cases might be given another chance, as records for 1 year only are not as accurate in indicating a cow's producing ability as records for 2 years or more.

In making yearly herd summaries of the kind shown in Table 48, compute the averages on a "cow-year" basis, so that comparisons can be made more accurately between herds for a given year and for year-to-year comparisons for a herd. A cow of producing age that has been in a herd the full 12 months represents 1 cow-year, even though she was dry part of the time. A heifer freshening July 1 for the first time would represent ½ cow-year. The following example should make this matter clear. In a given herd the following figures show the length of time certain cows were a part of the herd:

	MONTHS
5 cows for 12 months	60
1 heifer freshened May 1	7
1 cow sold June 1	5
1 heifer freshened July 1	6
	78

78 ÷ 12 = 6.5, or the number of cow-years

NOTE. Figures are for a testing year starting Jan. 1.

In summarizing the records for a year, the form shown in Table 48 is suitable for recording the information for each cow and for making over-all herd averages.

Comparisons from year to year in a herd can be made in terms of average milk and butterfat production per cow, as previously discussed These can be helpful in noting whether progress is taking place regularly year by year Of course, as the herd average increases to levels of 300 lb and better, it will become increasingly difficult to bring about improvement

A steady increase of 10 to 25 lb in the average annual production of butterfat in a herd having a normal number of immature heifers in production, regular milking, efficient feeding, proper calving intervals, good herd health, normal dry periods, and efficient culling taking place can be considered quite satisfactory until the herd reaches an average of 360 to 400 lb of butterfat per year Above that level, increases will come about much more slowly, and occasional years of "backsliding" can be expected For example, the following annual averages were made in a herd in Wisconsin

Year	Pounds	Year	Pounds
1924	267	1934	312
1925	255	1935	330
1926	245	1936	342
1927	295	1937	362
1928	297	1938	356
1929	300	1939	375
1930	317	1940	385
1931	310	1941	394
1932	325	1942	430
1935	323	1943	432

During the period from 1924 to 1927, this herd had a severe infection of Bang's disease Following that time, a program of control was started Around 1930, a more rigid program of culling was started and better sires purchased, which reflected a further stepping up during the most recent 5 years In addition, improvements were made in feeding and breeding practices

In a herd in Michigan, the annual butterfat averages for 3 years were as follows

Year	Pounds
First	313
Second	339
Third	361

TABLE 48. HERD SUMMARY FOR YEAR*

Name of owner of herd____________________

Name of student tester____________________

Beginning of testing period____________________
Month Year

Cow's name	Eartag or reg no	No months cow in herd†	Pounds of milk‡	Pounds of butterfat‡	Average test§	Remarks
Herd total	xxx				xxx	
Herd average‖	xxx					

* From form developed by G P Deyoe and A. C. Baltzer Michigan State College, East Lansing, Mich.

† Every cow whether dry or in milk that has had at least one calf is included for the actual months in the herd. If a cow is sold during the testing year, indicate the number of months up to the time of removal from the herd If a cow died, indicate the number of months up to the time of death. Heifers freshening for the first time are included for the number of months after the freshening date (Compute number of months to nearest 0 1 month.)

‡ For each cow, enter actual pounds of butterfat and milk for the testing period, as shown by the totals on the yearly production record for that cow

§ Compute average test for each cow by dividing pounds of milk for the year into pounds of butterfat produced by that cow and multiply by 100 In computing average test for the year for the herd, divide total pounds of milk produced by the herd into total pounds of butterfat, and multiply by 100

‖ In computing herd averages, divide the herd totals for milk and butterfat by the number of cow-years. To compute cow-years, divide the total (cow-months) for the third column by 12.

The increases indicated have been accompanied by a program of good feeding, improvement of barn conditions, some culling, and the introduction of well-bred heifers raised on the farm. The progress shown is very commendable and to a large extent was aided by the intelligent use of production records.

In another herd for which records are available, the annual butterfat averages were as follows:

YEAR	POUNDS
First	298 6
Second	365 6
Third	264 6
Fourth	343 6

In this case, the increase during the first 2 years was exceptional, but the herd had a severe infection of mastitis in the third year. However, after applying control measures, this herd was on the way back in the fourth year. The records show how an outbreak of disease can affect progress in a herd.

4. Keeping and Using Records for Beef Cattle

As with other livestock, several types of records are desirable for beef cattle. For animals being fed for market the following records are important: (1) records on rate of gain as one form of production, or performance, records; (2) feed records; (3) financial records. For a beef breeding herd, it is usually desirable to keep (1) breeding and health records, (2) production records, or records of performance for individual cows or the herd as a whole on rate of calving and gains of offspring, (3) feed records, and (4) financial records.

Keeping Breeding and Health Records. In a beef breeding herd of purebred animals it is desirable to keep breeding and health records for each cow similar to those for dairy cattle, as shown in Tables 41 and 42. Even for a farm herd for producing beef for the market, it pays to keep individual records of this kind as an aid in selecting and culling animals on a performance basis. Under range conditions, however, it usually is not possible to keep breeding records on individual cows, although it is important to check on each cow during the year to see if she raised a calf.

Keeping Production, or Performance, Records. Production, or performance, records for beef cows are somewhat different from those for dairy cows. Instead of a direct check on milk and butterfat production, records are kept on each cow in terms of gains and type of her

TABLE 49 RECORD OF PRODUCTIVE PROJECTS IN BABY BEEF*

No. of steer	Owner	1st wt Sept. 23 lb.	2d wt Jan 23 lb	3d wt Apr 18, lb.	Final wt Sept 12 lb.	Gain from 1st to 2d wt lb	Gain from 2d to 3d wt lb	Gain from 3d to final wt lb	No of days to gain 1st wt	No of days to gain 2d wt	No. of days to gain 3d wt.	Av gain per day, lb. 1st	2d	3d	Total gain, lb.	Av gain for total period lb.
1	Robert Allen	410	560	775	990	150	215	215	122	85	147	1 25	2 53	1 46	550	1 64
2	Robert Allen	390	545	750	1 010	155	205	260	122	85	147	1 27	2 41	1 77	620	1 81
3	Robert Allen	470	600	775	990	180	175	215	122	85	147	1 48	2 06	1 46	570	1 61
4	Robert Allen	440	620	810	1 015	180	190	205	122	85	147	1 48	2 23	1 39	575	1 62
5	Robert Allen	345	500	670	905	155	170	235	122	85	147	1 27	2 00	1 59	560	1 58
6	Harold Lentz	460	640	820	1 030	180	180	210	122	85	147	1 48	2 12	1 43	570	1 61
7	Harold Lentz	475	715	885	1 140	240	170	255	122	85	147	1 97	2 00	1 73	665	1 88
8	Virgil Turner	425	630	860	1 165	205	230	305	122	85	147	1 68	2 71	2 07	740	2 07
9	Virgil Turner	415	625	805	1 030	210	180	245	122	85	147	1 72	2 12	1 67	635	1 79
10	George Eifert	(Oct 12) 420	(Jan 14) 595	770	960	175	175	190	94	94	147	1 86	1 86	1 29	540	1 61
11	George Eifert	(Oct 12) 472	(Jan 14) 635	805	1 030	163	170	225	94	94	147	1 73	1 81	1 53	558	1 66
12	Grant Putman	375	490	640	1 085	115	150	445	122	85	147	1 11	1 76	3 02	710	2 01
13	Grant Putman	390	535	725	940	145	190	215	122	85	147	1 39	2 23	1 46	550	1 55
Total		5 437	7 690	10 090	13 310	2 255	2 400	3 220	1 530	1 123	1 911	19 67	27 84	21 87	7 873	23 15
Average		418 2	591 5	776 1	1 023 8	173 3	184 6	247 7	117 7	86 4	147	1 51	2 14	1 68	605 62	1 73

* Williamston Mich

offspring. These records are valuable in determining the cows that produce rapid-gaining offspring of approved type, as described in Chap. 7. Such records aid in determining the value of each breeding cow in terms of her performance. Suggested forms for this type of records are shown in Table 29 (page 369). A slight modification of this record form for the individual calf would include (1) gain during nursing period, (2) gain during the feeding period, and (3) market class or rating on type.

For any beef breeding herd, it is desirable to check the calving percentage, as this serves as an index to breeding efficiency. The ideal in most cases would be one calf per year per cow of breeding age, as explained in Chap. 7. Thus, if 50 cows raised 45 calves in a year, the calving percentage would be 90. On the range, it is also desirable to identify cows by using some marking system, so that shy breeders can be eliminated.

When beef cattle are being fattened, some kind of check on rate of gains should be made at regular intervals. Animals may be weighed individually or in groups, or several animals in a herd can be marked and weighed at intervals as a check on the entire group. Suggestions for weight records for individual animals are given in Table 49. Some boys at Williamston, Mich., conducted steer projects and weighed their calves by having them trucked at stated intervals to a scale located in a central place. The records were valuable for checking on feeding practices and led to several improvements of rations in cases of slow gains.

As a simple record for weights of groups of animals, a form similar to that in Table 50 may well be used.

Keeping Feed Records. Accurate feed records are as desirable for beef cattle as they are for other kinds of livestock. Where individual animals or small numbers of animals are kept separately, it is quite simple to keep feed records. Grain can be placed at intervals in fairly large bins and a record kept as the bins are refilled. Daily weighings and records of grains fed can be made if desirable, or weighings can be made 1 day per week and the total feed consumed computed from this record. It is more difficult to keep accurate records of hay and silage. However, the suggestions given for dairy cattle on page 411 should be helpful.

Keeping Financial Records. For stockmen raising beef animals or fattening beef animals, cost accounts, or financial records, are desirable.

TABLE 50 WEIGHT RECORD

Date	No of animals	Weight		No of days since last weighing	Gain		
		Total	Average		Total	Average per head	Average per head per day

Suggestions for cost accounts for breeding stock can be obtained from the items listed on pages 390 to 392 Suggestions for records on a steer fattening, or feeder, project can be obtained from the form shown in Table 54 in the Appendix

Interpreting and Using Beef Records Some of the suggestions given for hogs and dairy cattle should be helpful in interpreting beef cattle records

Such items as calving percentage and gains per day can be interpreted by comparing them with averages for the group and data from other sources, as described on page 392

Profits or losses, as well as labor income, are computed from the financial records Whether or not these are large or small, a study of various items such as feed costs should be helpful in finding where improvements are possible

As each person interprets the records for his beef project, it is desirable for him to note the approved practices that he applied in his situation It is also desirable to note which practices were omitted or applied poorly so that improvements can be made in the next cycle of production

5 Keeping and Using Records for Sheep

Desirable types of records for sheep include (1) breeding records, (2) records of production or performance, (3) feed records, and (4) financial records

Keeping Breeding Records. Ewes are usually bred by letting the ram run with the flock throughout the breeding season Hand breed

ing, in which the ewe is taken individually to the ram, is practiced in some purebred flocks. In such instances, breeding records of individual ewes are easy to keep. In the group or flock breeding method, some flockowners smear the brisket of the ram every other day with a paste made of lard or linseed oil and red ocher or lampblack, so that the ewes are marked as they are served. By a daily check, it is thus possible to determine which ewes were served.

Many flockowners do not keep breeding dates for individual ewes in their flocks. Instead, they keep the ewes in small numbers with only one ram, and thus they know the sire of each lamb born the following spring.

Keeping Production, or Performance, Records. The nature and value of production records, or records of performance, for individual ewes are discussed on page 378.

In developing records for flock improvement, have some system of checking on wool and lamb production for each ewe. If records of individual ewes are not kept, it is possible to make a flock checkup in terms of average pounds of wool per ewe, grade of wool, weight of lambs at 135 days computed to an average per ewe, and per cent of lamb crop. These flock averages give an indication of the efficiency of the entire flock.

A suggested record form for individual ewes is shown in Table 51. Data from year to year for a given ewe can be entered on the record form started for that ewe.

In the case of fattening lambs, periodic checkups on weights aid in checking on rate of gain and thus provide a basis for determining if feeding and other practices are favorable. Suggestions in Tables 49 and 50 for weighing steers should be helpful.

Keeping Feed Records. Records of the feed consumed by the breeding flock can be estimated in large amounts from feed stored in bins and hay used entirely by the breeding flock. The acreage of pasture can be figured from the amount used exclusively for sheep. If pastures are used jointly with other livestock or crops pastured that represent only part of the income from certain fields, estimates will be necessary.

Another method of determining feed consumption is to weigh the amounts fed on typical days and from these weighings compute the weekly or monthly amounts. Where large feeding operations are carried on, it may be desirable to keep daily records of feed consumption.

Keeping Financial Records. With sheep as with other kinds of livestock, complete cost accounts are desirable. For feeding or fattening lambs, the summary form in Table 51 in Appendix I is suggestive of the type of records that should be kept.

Interpreting and Using Sheep Records. Records of lamb and wool production for individual ewes are useful in determining which ewes to retain and which to cull, as well as in deciding which offspring to retain for replacement, as explained in Chap. 7.

TABLE 51. BREEDING AND PERFORMANCE RECORD FOR INDIVIDUAL EWE*

Single________

Ewe no.________ Reg. no.________ Birth date________ Twin________

Breed________ Sire________ Dam________ Triplet________

Year	Bred		Date lambed	Lamb no.	Sex	Birth		Weaning		Fleece		Disposal of lambs
	Ram	Date				Wt.	Grade	Wt.	Grade	Wt	Grade	Remarks

* From *Extension Bulletin* 242, Michigan State College, East Lansing, Mich.

As various records are summarized, they are helpful in determining causes of success or lack of success. For example, if the lambing percentage for the flock is low, it would be well to analyze the situation to determine the conditions that are responsible for this and which prac-

tices need to be improved. If the lambs reach market weight at an age older than seems desirable, conditions of feeding and health need to be analyzed carefully.

SUPPLEMENTARY ACTIVITIES

1. Set up a system of appropriate records for livestock you own or plan to own. Include breeding records, production records, feed records, and financial records.

2. Analyze some of the above kinds of records that have been kept for a period of time. Where did the practices seem to be satisfactory? Unsatisfactory? What changes should be made?

3. Start a system of simple production records for the dairy herd on your farm, using some of the forms suggested in this chapter. After keeping these records for a year or more, analyze the information to determine which cows to cull and which heifers to keep. Where possible, make daughter-dam comparisons. What practices should be used if production is to be increased? What goal of production per cow do you believe could be reached at the end of the year?

4. Set up a system of production records for another enterprise on your farm to measure the phases of production most closely related to profits. Make use of these records in improving the enterprise, in selling surplus stock, and in other constructive ways.

9. Marketing Livestock and Livestock Products

THE IMMEDIATE interest of the livestock raiser in marketing is to sell the product of his herd or flock and collect the money for it. This sounds simple enough If the stockman is satisfied to sell his product to the most readily accessible purchaser at the price offered marketing is simple There are usually buyers or buying agencies near at hand who are ready to buy, at a price whatever the producer wishes to sell

A good many factors influence the net price the producer can get for the goods he has to sell at a given location and at a given time There are several different methods of marketing available to nearly every livestock producer in the United States whatever his location If the producer is to sell to the best advantage he must be informed concerning all the factors that influence price at a given time and place In some instances he must try to select from the several methods of marketing the one that will result in the highest net price to him In the end the factors that influence price generally are of much greater significance than the particular method of marketing If any one method of marketing should regularly result in lower net prices that method would soon lose the support of producers and be discontinued

The activities requiring attention in livestock marketing will be discussed under the following headings

1 Selecting Effective Methods of Marketing Livestock and Livestock Products
2 Determining Factors that Influence Market Prices
3 Marketing Hogs
4 Marketing Dairy Cattle and Milk
5 Marketing Beef Cattle
6 Marketing Sheep and Wool

7. Marketing Horses and Mules
8. Marketing Purebred Animals

1. Selecting Effective Methods of Marketing Livestock and Livestock Products

When man first domesticated animals, each family maintained only enough animals to supply its own needs for animal products. As people began to live in towns and cities, those remaining on the land began to slaughter, deliver, and sell meats and other animal products to those in thickly populated areas. As cities grew larger, the several agencies involved in present-day marketing, processing, and distributing animal products appeared one after another, to form finally the present-day livestock marketing system.

At the present time, 75 per cent of all the people in the United States live east of the Mississippi River. Nearly 75 per cent of all livestock is produced west of the Mississippi River. This means that, in marketing, 50 per cent of all the livestock produced in the United States must be transported from the surplus-producing area west of the river to the surplus-consuming area east of the river. To accomplish this, there has developed, principally in large cities along the Mississippi and Missouri rivers, a number of large market centers to which the livestock is sent by the producers and sold to processors; the meat is then shipped on to retail meat shops to be sold to consumers. There are about 70 such livestock market centers in the country. Some of the larger are at Chicago, South St. Paul, St. Louis, Kansas City, St. Joseph, Omaha, Sioux City, Denver, Wichita, and Indianapolis. One of these markets is shown in Fig. 223.

Chicago was the first city in the United States in which a large central livestock market was established, the Chicago Union Stockyards. Owning and operating the market is the Chicago Union Stockyards Company. The Chicago Union Stockyards was opened for business on Christmas Day, 1865. It soon began to receive more animals weekly than were being offered for sale at any other one place in the country. Because of its advantageous location, the Chicago market has continued to receive more animals annually than any other single market anywhere in the United States or in the world. Various types of markets are used by livestock producers in marketing their livestock. These include large central markets, local markets for direct

buying, local auctions, and traders who buy and assemble livestock to sell at central markets, local markets, or local auction.

A good marketing system should accomplish the following:[1]

1. It should be operated in such a way as to keep costs to a minimum, but at the same time, maintain quality of service.
2. Quality differences between animals should be reflected in the prices paid to producers.
3. Livestock should be sold only on the merits of the animals, and each buyer and seller should be treated impartially.
4. The market should be operated in such a way that it will not be subject to manipulation by either buyers or sellers.

Making Use of Agencies Essential to a Large Central Livestock Market. Large central or terminal markets are under the supervision of the U.S. Department of Agriculture. The agencies and groups required for the successful operation of a large central livestock market include the stockyards companies, commission firms, dealers, shippers, buyers, transportation facilities, market reporting agencies, and health-control officials.

The Stockyards Company. It is the business of the stockyards company at a large market to provide pens for holding animals; to supply water and feed to the commission firms so that they may feed and water the animals; to provide scales for weighing; and to provide men to keep the yards in repair, keep the pens clean, deliver the feed, unload and place incoming animals in pens, and weigh animals. For this service, it charges a per head yardage fee on all incoming animals. This must be collected by the commission firm to whom the animals are consigned to be sold and paid to the stockyards company. The stockyards company sells the feed to the commission firms, and the commission firms, in turn, sell it to the shippers The commission-firm employees determine how much feed is needed by each shipment of animals; then they place that much before them and collect from the shipper. The feed is sold at a price considerably above cost, and the stockyards company has thus two sources of income, the yardage fees and a profit on the feed.

Commission Firms. In the development of the large livestock markets, it was apparent from the beginning that an agency was needed to represent and look after the interests of the many persons shipping livestock to the market to be sold Such agencies have always been on

[1] From W J Wills, University of Illinois

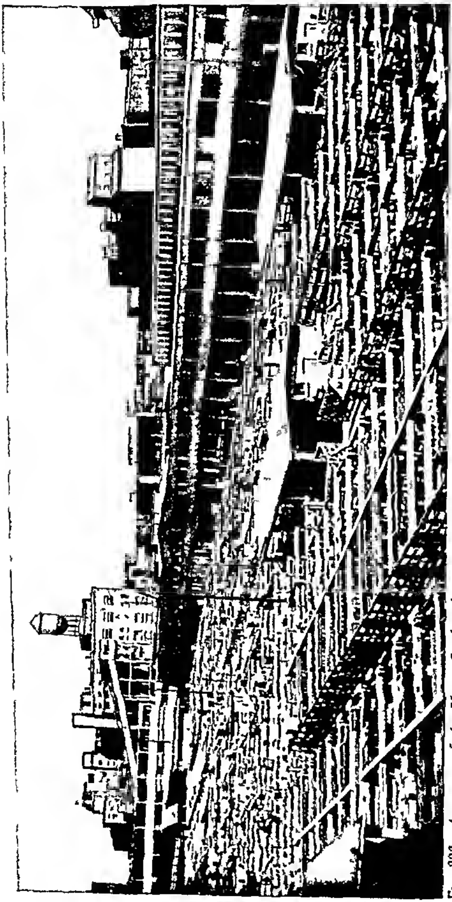


Fig 223 A section of the Union Stockyards at South St Paul, Minn Cattle pens in the foreground, double-decked hog pens at the right, and a large meat-processing plant in the background (*Central Cooperative Association.*)

hand as individuals or companies as soon as a new livestock market was ready to operate. They are commonly called "livestock commission companies" because their principal business is to sell livestock consigned to them. For this service, they charge a commission, or fee. Practically all such agencies operating on a large market also buy animals, on commission, for anyone wishing to place an order with them. There are always a number of commission firms and usually one or more cooperative selling agencies operating on a large market The livestock raiser or shipper must select the one to which he wishes

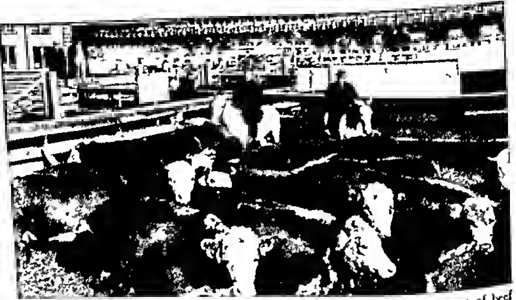


FIG. 224 A member of a commission firm acting as seller for a shipment of beef cattle is shown with a buyer for a processing plant In dealing, the buyer requests the seller to state the price per 100 lb for which he will sell. The buyer may then make an offer, and after some discussion, the two agree on a price and the sale is made (*Swift & Co*)

to consign his animals to be sold. Since the fee for selling is paid by the shipper, the selling agency naturally tries to sell the animals to the best possible advantage (see Fig. 224).

Any shipper may take or ship animals he wishes to sell to a large market and sell them himself. The individual shipper, however, can hardly hope to be informed on all phases of the handling and selling of animals at a large market; nor can he be informed about opportunities to contact buyers. Most important of all, he can hardly expect to be able to classify, grade, and price his animals accurately enough to secure the maximum price obtainable for them. The stockman will

invariably gain by consigning to a commission firm whose employees know how to get the largest obtainable price for the animals, even though he must pay a small fee for this service Most shippers do not accompany shipments of animals to large markets They consign the shipment to a commission firm and wait for the account of sale and check in payment to be mailed to them by the commission firm Commission firms are bonded, and there is thus no risk of the shipper's losing his money owing to a sudden bankruptcy of the firm

Dealers At every large livestock market, there is always present a group of persons or firms known as "dealers" These persons and firms make a business of buying certain kinds of animals and selling them again They are sometimes referred to as "speculators" or by the less complimentary term "scalpers" Dealers usually specialize in some one class of animals such as feeder cattle, milker and springer cows, or feeder pigs They serve a purpose by always being ready to buy one to several animals of the kinds that have a place back on the farm or ranch to be grown out, fattened, or used for milk cows, rather than being destined for immediate slaughter These dealers buy in small lots, put the animals they purchase together in larger uniform lots of a carload or more, and thus are able to sell and ship such animals to better advantage than are the commission firms In reality, dealers render a service to the seller of such animals as have their greatest usefulness when shipped back to farms, feed lots, or ranches and to persons desiring to purchase such animals in large numbers

Shippers *The term "shipper" is applied to anyone sending animals* to a large market to be sold Shippers may be individual farmers or local buyers who buy animals at country points, then ship them to the large markets and sell again Shippers include cooperative livestock shipping associations and large ranchers

Buyers Naturally, if a market is to succeed, there must be buyers present to buy all animals received, as shown in Fig 224 Markets that have two or more large packing houses adjacent to them have an advantage over others that are without the buying volume of the local large packing house Many sizable markets, however, sell most of the livestock received for reshipment to other points The market at Fargo, N D , is an example of such a one

Transportation Facilities When the large livestock markets in the United States were first established, they were located in towns with extensive railway facilities The trend of the last 25 years has been

toward increasing the transportation of livestock to market by truck. A livestock market is therefore no longer so dependent on railway transportation facilities. At many of the large markets, 75 to 90 per cent of all the animals received are delivered in trucks. For short-distance transportation of animals, trucks have the advantages of convenience, shipping less than carload lots, shorter time between farm and arrival at the markets, and, in some instances, slightly lower cost. The lower cost is secured only when the animals are transported in trucks owned by the shipper.

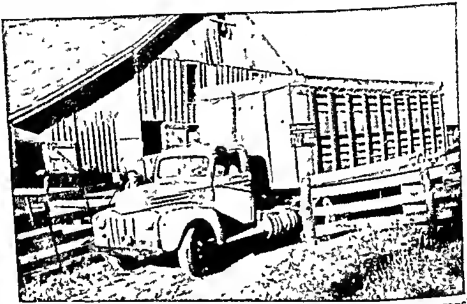


FIG. 225. Many animals are delivered directly to market from farm or ranch in trucks This large truck is leaving an Iowa farm with a load of fat cattle late in the afternoon The cattle will arrive in Chicago in time to be on the market the next morning (*A M Wettach, Iowa*)

Market Reporting Agencies. Every large market needs at least one good market reporting agency to collect and distribute daily market reports. This is a service demanded by shippers and buyers alike so that they may know the approximate prices prevailing for different kinds of animals being sold on the market from day to day. Daily market reporting papers still supply this need, although they are now supplemented by reports collected and distributed by the U.S. Department of Agriculture, Market Reporting Service. Most farmers now get their market reports over their radio. Many radio stations supply market reports free. They, in turn, secure the market information they give out from the U.S. Department of Agriculture, Market Reporting

Service. The service itself distributes one or two radio reports each day from each of the large markets in the country.

Health-control Officials. At every large market, two groups of health-control officials are always present. One group represents the livestock sanitary board of the state in which the market is located; the other, the Bureau of Animal Industry of the U.S. Department of Agriculture. It is the duty of the state agency to see that all animal health regulations and control measures applying to animals originating within the state or destined to any point within the state are complied with. The group

FIG. 226. Utah Future Farmer lightweight Hereford class at an intermountain junior-fat-stock show in Salt Lake City. The cattle are graded according to the United States standard market grades and sold accordingly. (*Mark Nichols, Salt Lake City, Utah.*)

of veterinarians representing the Federal government has the responsibility of seeing that all health regulations covering animals coming to the market from outside the state or leaving the market for shipment outside the state are complied with.

The inspection and control measures carried out by both agencies are directed toward the control of animal diseases and prevention of the spread of disease. The inspection of meats in packing houses is carried on by still a third group of veterinarians in the employ of the Federal government.

Thus it is seen that the operation of a large livestock market is a

complex procedure A large market is a large enterprise The turn over of money on each of a number of the larger markets in the United States averages more than $1,000,000 daily for every day in the year

Marketing Livestock Cooperatively. The cooperative marketing of livestock is one of the newer developments in marketing procedure Growth of this marketing plan has been rapid Approximately 25 per cent of all commercial livestock sold annually in the United States is now marketed cooperatively.

Cooperative Shipping Associations The cooperative marketing movement had its start during the days preceding truck transportation and direct buying when, in mixed farming areas, nearly all livestock was purchased from the producer by local buyers and consigned by them to commission firms at the central markets The reason for the development of cooperative marketing was a belief on the part of producers that they were not getting full value for their livestock from the local buyers The purpose of the shipping association was to eliminate the local buyer by consigning the livestock directly to the commission firms at the central markets To accomplish this, the smaller producers had to group together in order that shipments of full carloads of animals might be made The larger producers and ranchers of the West were already following the plan of consigning carload shipments directly to the commission firms With the development of trucks and better roads, shipping associations have decreased greatly in number

Cooperative Selling Agencies The proposal that shipping associations organize their own selling agencies to receive and sell their livestock on the central markets was first advanced during the period of the First World War, 1914–1918 Action on the proposal was first taken in Minnesota, where a state federation of shipping associations was formed This federation, on May 11, 1921, incorporated as the Central Cooperative Commission Association[2] to serve as the selling agency on the market at South St Paul for cooperative livestock shipping associations in Minnesota and surrounding states This selling agency opened for business Aug 8, 1921 Within a year it was receiving and selling 25 per cent of all the livestock arriving at the South St Paul market

Through promotion by the American Farm Bureau Federation, cooperative selling agencies were soon established at about 15 other central markets, and about 15 such agencies were organized by the

[2] Name later changed to Central Cooperative Association

Farmers' Union. For the most part, the Farm Bureau and Farmers' Union avoided establishing agencies at the same markets. By 1930, these and other cooperative selling agencies were handling about 25 per cent of the receipts of livestock at the more important markets.

At several markets, there are two or more cooperative agencies representing different groups of producers. Individual farmers may consign their livestock to a cooperative selling agency through a local shipping association, or they may become members of the central selling agency as individuals and consign directly to the central selling agency. Much of the livestock now sold by cooperative selling agencies is consigned directly to them by producers and does not pass through a local shipping association.

Direct Selling by Cooperative Organizations. In certain sections of the country, notably the states of Illinois, Indiana, Ohio, and California, local cooperative shipping associations have developed direct selling to packing companies without passing their livestock through a central market or through the cooperative selling agencies located at them. This plan has met with moderate success. An attempt was made to introduce selling by carcass weight and grade into this selling plan, but that feature has not yet developed extensively.

Local Markets and Direct Buying. Before large cities, industrial centers, and railways appeared, many small slaughtering plants, owned largely by retail meat dealers, were maintained throughout the country. Most of these disappeared with the advent of the large processing companies. Some continued and some new ones came into existence, generally adjacent to towns of sufficient size to provide a good market for meat. In so far as they can, the small processing companies buy live animals at their plants as producers truck or ship them in. Often, they find it necessary to send buyers out some distance to make purchases in order to secure sufficient animals to supply their trade.

Theoretically, there is a place for the small processing or packing company in densely populated areas as well as in heavy producing areas. In densely populated areas, the small processor should have an advantage in processing the nearby local supply of animals and distributing the meat as far as it goes. In heavy producing areas, local processors should have an economic advantage over large processing companies in processing and distributing that part of the nearby supply of livestock required in the local trade. The large companies then might be expected to have an advantage in attracting the surplus

animals from heavy producing areas to large market centers and in processing and distributing the product over long distances to consuming centers In practice, the processing and distributing of meat do not work out in just that way The tendency has been for some of the small processing plants to grow to such a size that they must enter into national competition with the large companies to dispose of surplus products The branch house and car-route systems of the large companies have made their products available to practically every retail meat dealer in the country, so that they can compete with the small local independent or interior processor right in his own home town

Because the large processing companies were compelled to sell a large part of their products to the armies of the Allies during the First World War, the small companies were able to make rapid growth By the end of the war, the smaller companies were cutting in appreciably on the supplies of live animals formerly sent to the large central markets In order to meet this buying competition, the large companies began in various ways to buy animals at local points for shipment direct to their processing plants located at the central markets Buying at the local shipping point by large processing companies has increased rapidly during the last 20 years Since animals purchased in this way are delivered direct to the slaughtering plant of the purchaser and do not pass through the markets, this method of buying has been designated "direct buying" The rapid increase of direct buying during recent years has reduced the number of live animals that pass through the central markets The influence of this change in buying practice upon the net price received by the producer has been the subject of much discussion

The principal advantages of direct buying are the convenience to the producer of livestock, the knowledge of the price before the livestock leave the farm, and the small cash costs of marketing The disadvantages are that direct buying may not provide the best possible prices for all classes and grades of livestock, farmers do not know livestock grades and values well enough to determine whether the price offered is fair, and there is a chance for inaccurate weighing

Using Auction Markets The selling of farm animals by auction has been practiced in various ways throughout the history of livestock marketing This plan of selling has been and still is extensively used in the selling of purebred animals for breeding use Use of the auction for selling purebreds is considered later in this chapter in the section

on selling purebred livestock The auction has also been extensively used at horse and mule markets in selling commercial animals It is well suited for selling animals wherever the market price varies widely and where the types of animals are those most logically sold by the head rather than by the pound The latter is always the case with horses and mules

During recent years, there has developed a new plan of selling farm animals in the form of the local auction market Such markets have been established in many towns throughout the country by men who saw an opportunity to render a service and make a livelihood from it The *service they render is to maintain a local sales place to which* anyone may bring animals to be sold and to which anyone may come to buy The kinds of animals generally brought to such local auction markets to be sold are those for which there is a demand in the community, included are work horses and mules, milk cows, feeder pigs, bred sows, ewes, feeder cattle, lambs, and sires—bulls, boars, and rams

The plan of operation is that the operator of the market provides a building or sales pavilion suited to the seating of a number of prospective buyers He also provides pens for yarding animals and feed, water, and weighing facilities Usually, he decides upon one or two days a week as sale days on which auctions are held Consignors may then bring animals to the market, where they will be offered in the auction and a fee charged for selling them

This new marketing plan has much to recommend it as a means of disposing of certain kinds of animals, especially those which farmers in the community want to buy and others have to sell The local market should be an ideal means of getting such buyers and sellers together and the animals exchanged at the lowest possible marketing cost To date, this marketing plan has had only modest patronage and moderate success As the equipment for such markets improves, the management gains the confidence of patrons If sanitation and health protection measures are rigidly enforced by the operator, the local auction markets may assume an important place in the broad field of livestock marketing

The principal advantages of local auction markets are that they are convenient and that the seller can see his livestock sold The disadvantages are that the charges may be relatively high, sanitation standards may be quite low, and in some cases much of the livestock on the market may be bought and sold by traders

Selling to Traders Traders usually buy at the farm, and the bargain is strictly between the buyer and seller There are usually no cash costs to the seller Traders assemble a load of livestock which they sell at a terminal market, local market, or auction The seller is often at a disadvantage because the trader usually buys on a "head" basis and he is usually a shrewd judge of weight and values On the other hand this method is convenient to the farmer, and he knows the price before the livestock leaves the farm

Preventing Livestock Losses In marketing livestock considerable loss results from death, bruising, and various forms of injury to the animals before and after they leave the farm or ranch These losses are estimated at $12,000,000 or more annually In the end livestock raisers really pay for these losses, even those covered by insurance Buyers of livestock plan on paying a price sufficiently low to offset damages that appear after slaughter Consequently, it is to the advantage of livestock raisers to take measures for reducing these losses

Many losses of this type can be prevented if livestock raisers use care in handling and loading the animals as they leave the farm or ranch and if the animals are hauled unloaded, and sorted properly

The following suggestions by the National Livestock Loss Prevention Board are helpful in preventing losses in getting livestock to market

1 Use good loading chutes
2 Use partitions to separate mixed loads of livestock
3 Use wide open end gate trucks
4 Bed with sand to provide good footing
5 Wet the sand in summer and cover it with straw in cold weather
6 Avoid overcrowding of animals
7 Provide proper ventilation but avoid exposure to cold weather
8 Tie all bulls
9 Use canvas slappers and electric prods rather than canes or clubs
10 Allow animals to load and unload slowly
11 Remove all projections in trucks and cars
12 Keep livestock comfortable at all times

Other suggestions for proper handling are given in Chap 5 and in various sections of this chapter

Slaughtering Animals on the Farm and Selling Meat It will be recalled that in the early development of livestock marketing the chief method was the slaughter of animals on the farm and the sale and delivery of meats by the producer direct to the consumer This

method of marketing is still followed to a limited extent in many parts of the United States. The principal argument for it is that it affords an opportunity to eliminate all middleman charges and thus results either in low cost to the consumer or high return to the producer, or probably some advantage to both. The principal argument against it is that it is difficult to maintain satisfactory sanitation in handling, processing, and storing the meat. The recent development of the refrigerated locker for food storage has stimulated a revival of this marketing plan. It works best when the producer can sell an entire carcass or a half carcass to one buyer. The storage lockers make it possible for a family to buy at least a half carcass and store it satisfactorily.

2. Determining Factors That Influence Market Prices

Many factors exert an influence on the price the livestock raiser can get for his animals when he is ready to sell them. Some of these factors operate over long periods or periods of moderate length, and some

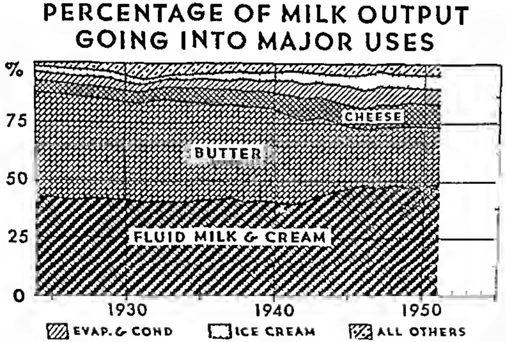


FIG. 227. Proportions of milk going into various uses are affected by consumer demand for various products. (*U.S. Department of Agriculture.*)

operate to cause fluctuations over periods as short as 1 week or even 1 day. Factors influencing prices may be discussed by grouping them according to the length of time over which they function, as long-time, cyclic, seasonal, and short-time influences.

Recognizing the Effect of Long-time Influences. The factors that bring about long-time price changes operate so slowly that they are not noticed even from year to year, although they may be detected in a long-time, historical study covering a period of something like 50 years or more. They are caused by such conditions as changes in the standard of living or earning power of the masses of people in a country or changes in production costs such as increasing land value, taxes, labor, and transportation costs. In a general way, the influence of such factors over a long period of years in the United States beginning as far back as about 1880 brought about a considerable increase in prices for all kinds of farm animals, except horses and mules. Replacement of horse and mule power by mechanical power, accompanied by a steady decline in the use of the former during the last 25 years, as shown in Fig. 5 (page 9), has resultetd in a long-time decrease in horse and mule prices.

Recognizing the Effect of Cyclic Influences. The price cycle as it applies to livestock raising may be defined as that period of time during which the price for a certain kind of livestock advances from a low point to a high point, then declines to a low point again. Cycles vary in length and degree of rise and decline for the same kind of animal and for different kinds of animals. For example, in reviewing the price cycles that have occurred for hogs over the last 50 years, it is found that the shortest required only 3 years, while the longest took 7 years. The average length of the price cycle for hogs is 5 years, while the average length of the cycle for beef cattle is about 15 years. The beef catdc cycle is shown in Fig. 228.

The price cycle is largely the result of the operation of the law of supply and demand in livestock raising. Starting with a time when the prevailing prices for a kind of farm animal are low and only moderately profitable or not profitable at all, many producers reduce their production or discontinue raising that kind of animal. In time, this brings the supply below the number needed. Buyers then begin offering higher prices in an attempt to secure enough animals to fill their needs. The result is a rising market, which in time makes production appear highly profitable and operators begin to increase numbers again. Prices usually continue to rise until they reach a point where consumers will not pay any more and will begin to decrease consumption of the high-priced product. In the meantime, production has been increased; in time the point is reached where there is an abundant supply of that

kind of animal, and buyers begin to bid lower prices This starts the price decline The decline usually proceeds more rapidly than did the incline

The decline does not stop until the price is so low that consumption of the product increases and uses up the surplus animals Often the price declines to the point where production is not profitable and raisers begin to go out of production again Selling of animals continues until a scarcity starts prices upward again

Throughout the history of livestock raising in the United States, price cycles have occurred, one after another, for all classes of farm animals The violence of cyclic fluctuations and length of time to complete a cycle have varied, owing to many influencing factors of short-

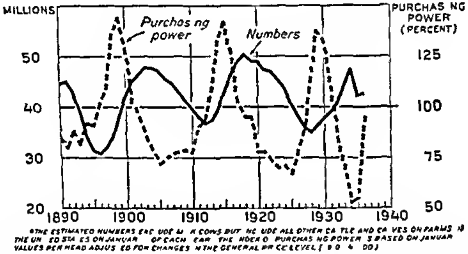


Fig 228 Solid line shows production cycle for beef cattle through the period 1890 to 1910 (*U S Department of Agriculture*)

time duration Some of the factors most likely to speed up or delay the completion of a normal cycle are droughts, wars, general financial depressions or booms, and finally one that entered the picture during the Second World War, the fixing of prices for which animals and animal products may sell by Federal government order

Recognizing the Effect of Seasonal Influences More or less regularly, price fluctuations for all kinds of farm animals occur during each year because of seasonal production and seasonal marketing of animals For example, the natural season of the year for the appearance of beef calves and lambs in ranch livestock production is the spring The logical marketing season is the fall, or close of the grazing season This means large numbers of range cattle and lambs on the markets during the fall months These heavy marketings cause large supplies for a

short period of time, which result in a temporary reduction in price. The same situation prevails in hog marketing, as shown in Fig. 229.

Recognizing the Effect of Short-time Influences. Coming under the heading of short-time influences are such items as the weather, which may delay shipments to market and cause a temporary shortage, with a consequent temporary rise in price. A marked increase or decrease from the normal number of animals arriving at a given market for even one day may cause a minor decrease or increase in price. A large special order appearing on a certain market may cause a temporary

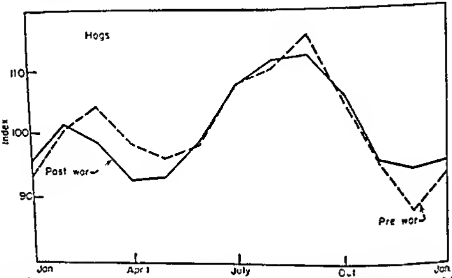


FIG 229 Index numbers of seasonal variation in the Indiana farm price of hogs, 1930 to 1939 and 1946 to 1950 (average of the 12 months equals 100) Hog prices are high in July, August and September, with a spring peak in February The post war seasonal variation is much the same as the pre-war (*Graph from Purdue University*)

increase in price The method of selling, whether at the farm, direct to a packer, or on a large market, would be expected to influence the selling price at the point of sale but should not influence the net price at the farm In practice, method of sale no doubt does somewhat influence the price in individual sales because of the inability of some individual buyer or seller to judge accurately the market class and grade of animals Shrewdness on the part of the specific buying agency accompanied by carelessness or inefficiency on the part of the seller or selling agency may influence price to some degree. Among the factors influencing price are the ability of both buyer and seller to classify and

grade animals correctly and to "peg" the animals being sold correctly in the prevailing price schedule The ability of buyer and seller to estimate the dressing percentage of the animal as it may be influenced by the amount of "fill," or feed and water, in its digestive system is another factor of some importance

Interpreting Factors that Influence Prices. Knowing that many factors influence livestock prices, the livestock raiser is confronted with the question of how he may proceed with reasonable assurance that he is receiving the highest net price he can get for his animals at the time

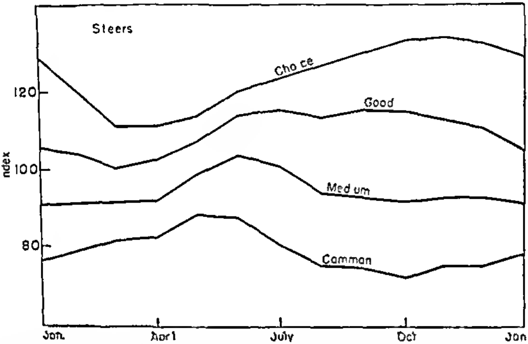


Fig 230 Index numbers of seasonal variation in Chicago prices of live steers of various grades 1946 to 1950 (old grading system) The average of four grades equals 100 The price spread between grades is small in spring and great in fall (*Graph from Purdue University*)

of sale For this purpose the long time trends may be ignored because their effect is not significant over short intervals and the producer can do practically nothing about them

However, knowledge of the cyclic trends is of great importance in planning production By securing and studying government statistical reports and market reports, the livestock raiser may keep informed as to the approximate location his kind of livestock occupies in the production cycle at the time This knowledge may be used to greatest advantage in planning production for the future For example, if all indications suggest that prices are due for an increase, that is the time

to retain breeding stock and plan for increased production Then, by keeping informed, the livestock raiser may with at least some degree of accuracy determine when prices are due for a decline and proceed to

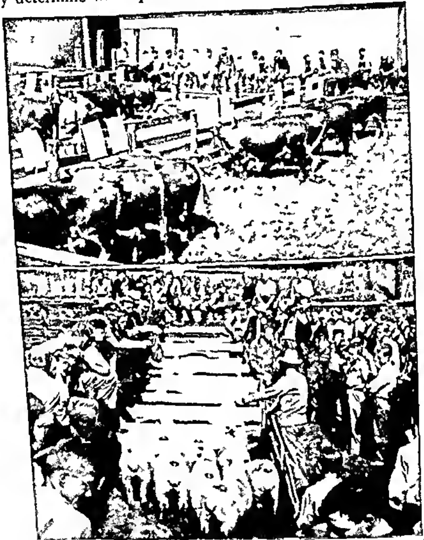


Fig 231 Students of vocational agriculture at Williamstown Mich learn the practical side of marketing Animals are assembled in the local stockyards for a market show just prior to shipment They are graded by qualified persons and the grading is explained to the boys thus giving them an opportunity to check on the results secured from the method of feeding they used

cull and reduce breeding stock before this decline has reached its full extent

This is just the opposite of the common practice of livestock producers who are not students of production and price trends Such producers usually find themselves heavily stocked when the low point in the cycle

is reached and low on breeding stock when prices have advanced again. They are always selling heavily on a low market and often buying breeding stock in order to get started again on a high market. It must be remembered, however, that cycles do not occur with fixed regularity and that their length and the degree of fluctuation within a cycle may be much changed by unusual influences. Such influences must be considered also in estimating the probable cyclic trend for the immediate future.

In many types of livestock raising, seasonal production and marketing are so definitely related to successful production and production costs that little can be done to escape seasonal declines. Livestock raisers living in locations that will permit planning production so that animals may be ready for market during known seasons of light marketings may benefit by somewhat higher prices.

Perhaps the livestock raiser has his best opportunity to secure the maximum possible price for animals from a thorough knowledge of small factors that may influence the sale price somewhat at the time the sale is made. Such items are (1) proper preparation of animals for shipment; (2) careful handling, driving, and loading into trucks or cars; (3) knowledge of market prices secured by daily listening to a good radio market report or by daily reading of a market report in a reliable publication; and (4) carefully selecting the marketing method that promises the largest net return on the home weight basis. After considering all the factors that may influence the price for which any given group of animals may be sold at a specified time, it must be concluded that the livestock raiser has little control over the price at which he will sell.

Livestock may be regarded as a semiperishable product from the marketing standpoint; that is, once a group of animals has been made ready for market, the sale cannot be long delayed without incurring heavy holding costs and, in many instances, depreciation in quality of the product. Granted that care has been taken to avoid small "leaks" by proper handling and loading and by using efficient salesmanship, the most one as a stock raiser can do toward influencing price is to strive to (1) produce a standard product of high quality, (2) avoid being caught with large numbers of animals on hand during the low points of the price cycles, and (3) in so far as possible take advantage of seasonal price trends in planning the time of year to have animals ready for market.

3. Marketing Hogs

Several characteristics of hogs and hog raising make the marketing of them less difficult than the marketing of cattle and sheep To a large extent, hogs are raised and fattened on the farms where they are born This is true because a pig is fed about the same kind of feeds from the time it is born until ready for market Any farmer who has feeds suitable for raising pigs also has feeds suitable for fattening them As a result, most hogs remain on the farm on which they were born until they go to market in finished condition for immediate slaughter

Owing to their body conformation, hogs, once they are made fat, vary less in value than do cattle and sheep Because a large part of the hog carcass can be cured and kept for several months without deteriorating in value, hog products can be purchased in large volume during periods of heavy marketing and stored for use after marketings have declined

One essential of fair dealing in any kind of livestock on a large market, and particularly in preparing an accurate market report, is a set of recognized market classes and grades Such a set of classes and grades has been developed for each of the three leading kinds of meat animals—hogs, cattle, and sheep

During the last 25 years, or since the Federal government through the U S Department of Agriculture, Bureau of Agricultural Economics, took the lead in market reporting, an attempt has been made to encourage the use of the same set of classes and grades and the same descriptive terms in reporting all livestock markets in the country Considerable uniformity has been accomplished though many markets still retain some class and grade descriptions peculiar to them

In reviewing the set of market classes, subclasses, and grades of hogs, as well as those for cattle and sheep, it should be kept in mind that the object of classifying and grading or "sorting," is to get animals into groups having sufficient uniformity so that all animals in the group can be sold or purchased at the same price per pound The descriptions must be brief, yet complete enough to convey to the reader of the market report or to the radio listener adequate information With this he can picture accurately the appearance of the animals to which the particular price quotation applies Although animals are not officially graded on the markets by a government grader after the manner of

grading grains, classes and grades are sufficiently well established as a standard so that animals are often purchased by class and grade without inspection by the buyer.

Classing and Grading Hogs. In classifying them, all hogs are first designated as hogs or pigs according to age. Young hogs are called *pigs* until they are about four months old or until they weigh about 140 lb., after which they are called *hogs,* especially in market language. The

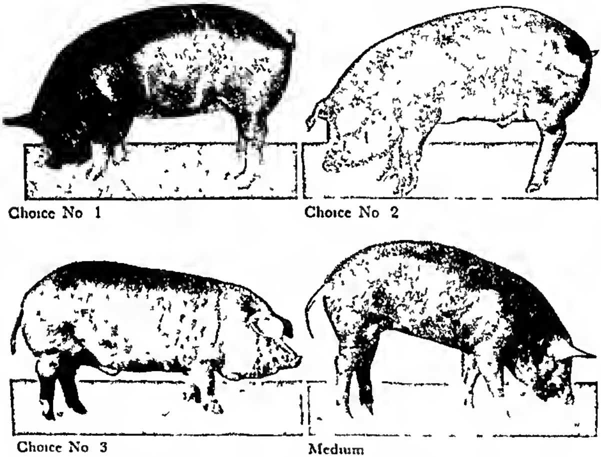


Fig 232. Representatives of market grades of slaughter hogs Cull grades not shown (*Livestock Branch, P.M.A., U.S. Department of Agriculture.*)

term *gilt* as used in the classification of hogs means a young sow that has not produced a litter of pigs. A *barrow* is a male pig or hog that was castrated at a young age. A *boar* is a male beyond the pig age. A *stag* is a male castrated after he reached sexual maturity. A *sow* is a female that has produced a litter of pigs. The terms *boar pig* and *sow pig* are commonly used to designate sex in very young pigs. The market classes of hogs and pigs are as listed below:

Hogs 180 Lb and Up
- Slaughter hogs
  - Barrows and gilts
  - Sows
  - Stags
  - Boars
- Feeder hogs
  - Barrows and gilts
  - Sows

Pigs under 150 Lb
- Slaughter pigs
  - Barrows and gilts
  - Roasters
- Feeder pigs
  - Barrows and gilts

In both slaughter and feeder classes of hogs and pigs, barrows and gilts are grouped together because sex condition influences their usefulness so little that a price differentiation is not warranted

In hog dealing and in market reporting, the classes are divided further on the basis of weight Because small variations in weight affect the dressing percentage and desirability of the cuts of meat, weight limitations are often very closely drawn, that is, barrows and gilts weighing 200 to 225 lb may sell at a higher or lower price per pound on the same market on the same day than barrows and gilts weighing 225 to 250 lb Usually, in dealing and in market reporting the range in weight is specified, though the terms *light, medium,* and *heavy* may be used to indicate approximate weights

Using Market Classification and Grading as a Guide in Marketing Hogs A large percentage of all hogs arriving at the markets classify as slaughter barrows and gilts There is a wide range in weight, though most hogs sent to market weigh between 160 and 350 lb, 200 to 250 lb covering a high percentage of the total The price per pound varies somewhat with the weight of the hog Usually the 200 to 250 lb weight is the market topping weight, provided that the hog qualifies for the good and choice grades At times however, weights slightly under 200 lb may outsell those over 200, at other times, weights over 250 may outsell those under 250 As a rule, the careful hog raiser can easily send his hogs to market with sufficient finish, or fat, on them and within the weight range that is bringing the highest price at the time

Ordinarily, it pays to feed brood sows for a time after litters have been weaned so that they will have enough fat on them to grade within the good and choice sow grades

The U S Department of Agriculture has recently released a new system of slaughter grades which are closely related to carcass quality, cut out value and ratio of lean to fat Five grades are recognized, namely, Choice No 1, Choice No 2, Choice No 3, Medium,

and Cull. The Choice No. 1 grade are slaughter barrows and gilts which have a moderate degree of finish in the form of fat, with other characteristics desired in top-grade carcasses. The Choice No. 2 grade has a high degree of finish, and the Choice No. 3 has a very high finish. The Medium-grade slaughter barrows and gilts are slightly low in finish, while the Cull-grade individuals have a very low finish. These grades are now used by the U.S. Department of Agriculture in reporting market prices (see Fig. 232).

Using Production and Price Cycles as a Guide in Marketing Hogs. Since the production and price cycles for hogs cover so short a period of time, it is important that the hog raiser follow government statistical reports and market reports very closely in an attempt to avoid being heavily stocked when prices are low and lightly stocked when prices are high. Because it requires only 18 months from the time a sow pig is born to the time her first litter may be ready for market and because the average number of pigs raised per litter is about six, it is possible to increase greatly the number of hogs produced in a period of 18 months. It would be unwise for the hog raiser to try to manage his hog enterprise so that he has no hogs to sell when prices are low and a large supply when prices are at or near the top of the cycle. The best he can hope to do is to cut down somewhat on the number of sows bred and sell closely when prices are high, then increase the number of sows bred when prices are low, thus preparing for a rise by the time the pigs are ready to market.

Using Hog-corn Ratio as a Guide in Raising and Marketing Hogs. A large percentage of all the hogs produced in the United States is raised in the Corn Belt. In this area, the principal feed is corn. A simple formula known as the "hog-corn ratio" has been devised by which the Corn Belt hog raiser can determine with considerable accuracy whether or not he is making a profit on his hogs and can also judge his position in the hog price cycle. The hog-corn ratio may be defined as "the number of bushels of corn that 100 lb. of live hogs will buy." The prevailing hog-corn ratio is stated as a single figure, such as 11.6 or 15.0 or 17.5. The figure is determined by first noting the live-weight price per 100 lb. at which good and choice slaughter barrows and gilts are selling, then dividing that by the price per bushel at which corn is selling. For example, if hogs are selling at $13.75 per 100 lb. on the Chicago market and corn at $1 per bushel on the same market, the hog-corn ratio is 13.75 divided by 1.00, or 13.75. If corn were selling

at $1.22 per bushel, the hog-corn ratio would be 13.75 divided by 1.22, or 11.28. In stating the hog corn ratio, usually only one place beyond the decimal is used; thus, in the first case, the ratio would be stated as 13.8 and in the second as 11.3.

The hog corn ratio exerts a strong influence on the plans that hog raisers make in raising and marketing their hogs. As an average from 1920 to 1951, the value of 12.3 bu. of corn represents the average price of 100 lb. of live hogs. That is, the average hog corn ratio is 12.3. Whenever 100 lb. of live hog is worth more than 12.3 bu. of corn, there

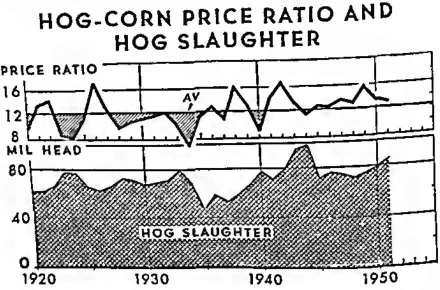


FIG. 233. The heavy straight line at the top shows the average hog-corn ratio for the period of 1920 to 1951. This average ratio was about 12.3. The fluctuating line at the top shows the changes in this ratio with the shaded portions showing periods unfavorable to hogs and the upper portions showing periods favorable to hogs. The lower part of the graph shows the fluctuations in the number of hogs slaughtered over the same period. (*U.S. Department of Agriculture.*)

is a tendency for farmers to increase swine production because the hog corn ratio is favorable. Whenever the opposite is true, there is a tendency to decrease production because the ratio is unfavorable. As an average, over a period of years, it has been found that a complete cycle of a favorable period followed by an unfavorable period and back again takes place about every 4 to 6 years. A profitable period of about 2 years seems to be just long enough to convince growers that they should raise more pigs, thus encouraging heavier production, then the 2 years following discourage enough growers to reduce the supply

of market hogs, and prices rise, so that a favorable hog-corn ratio returns (see Fig 233)

Other factors, such as corn yields, industrial and employment conditions, and export demand for pork products, have influenced both corn and hog prices This makes it impossible to predict just when the ratio will change However, the alert hog raiser will keep informed on the prevailing hog-corn ratio and whenever it is so low as to indicate a loss will market his hogs just as soon as they weigh enough to sell at or near the top prevailing price, then sell any leftover corn for cash On the other hand, if the hog corn ratio is high, indicating a substantial profit in feeding the corn to hogs, he will keep market hogs and continue to feed them until they reach the maximum weights that are selling at or near the top prevailing price, even if he has to buy corn to do it

Controlling Shrinkage in Marketing Hogs As a rule, hogs show a shrink of about 2 per cent in weight between home weight and market selling weight On short hauls, under favorable shipping conditions, this may be reduced to no shrink at all, on long hauls, under unfavorable weather conditions, the shrink may reach 10 per cent Short haul hogs are usually sold without being fed, though hogs that have been without feed as long as 8 to 10 hr are usually fed shelled corn at the markets As with cattle, the amount of shrink or fill at the market is of doubtful significance so far as net return to the shipper is concerned

Controlling Bruising and Injury. Loss due to bruising, injury, and death en route to market is considerable with hogs and, when totaled, represents a large sum of money each year Such losses could be somewhat reduced by more careful handling in loading, transporting, unloading, and sorting One frequent cause of loss is the tendency for strange hogs to fight one another when first turned in together If hogs are marketed by truckloads from individual farms, this situation can be improved by getting the truckload of hogs together in a roomy pen at least 2 days before they are to be sent to market If fighting starts, the fighters can be separated before one or more hogs become overheated, badly bruised, or crippled

Another cause of loss in shipment is by death due to suffocation or overheating Suffocation is often due to bedding the truck or freight car too heavily with loose material such as long straw and to overloading or crowding too many animals into the truck or car Bed trucks or cars in which hogs are shipped with about 2 in of fine sand In warm weather this should be soaked with water On extremely warm days,

experienced hog shippers suspend several cakes of ice in burlap sacks at different points in the car. The ice sacks should be hung at a height just above that of the hogs. Most stockyards have pens equipped with water sprays near the loading chutes so that if hogs come off a car or truck in a very warm condition they can be sprayed with water and

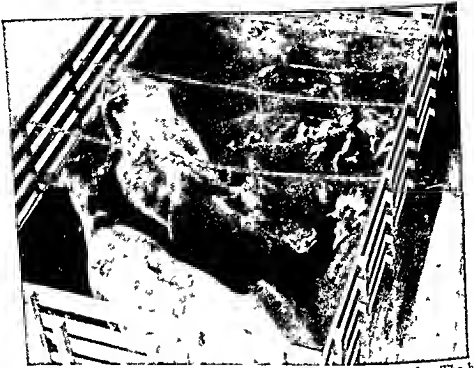


FIG 234. An undesirable way to haul cattle and hogs in the same truck The hogs should be separated by a partition from the cattle to prevent bruising and injury (*Successful Farming*)

cooled off before being driven to the pens of the commission firm Likewise, if hogs are being loaded for reshipment, they can be sprayed and cooled just before being loaded onto the car

4. Marketing Dairy Cattle and Milk

Beef and veal are looked upon as by-products of the dairy industry. As a consequence, little effort is made by dairymen to prepare dairy cattle for marketing Mature bulls and cull cows are usually sent to market at any time of year whenever they are no longer useful As a rule, it does not pay to fatten them Cows are usually sold when they have just completed a lactation period A good many dairy heifers are culled at ages between six months and two years. Some

cows and heifers of dairy breeding are handled on the markets as prospective milk cows. They are sold by the head rather than by the pound. On the large markets, there are usually one or more firms that specialize in milk cows, springers, and dairy heifers. These firms function as dealers, buying cows from the pens of commission firms and reselling them.

Marketing Veal Calves. Although veal calves are considered a by-product of the dairy industry, 90 per cent or more of the veal calves marketed in the United States are calves of grade dairy or nondescript

FIG 235. A group of choice veal calves on a central market (*Central Cooperative Association*)

breeding. The calves of such dairy breeds as the Holstein, Brown Swiss, and Ayrshire, along with the calves from the dual-purpose breeds, Milking Shorthorn and Red Polled, often make the choice and prime vealer grades if they are marketed at the correct age and weight and have been properly fed. Legally, calves may not be slaughtered and sold for veal until they are three weeks old. Calf meat should be sold as veal only if the calf has received no feed other than milk up to the time of slaughter. Calves that do receive feed other than milk should be sold as "calf" carcasses.

The time of year a calf will be marketed as a vealer depends on the time of year it is born. The most desirable age at which to produce

a *top veal* carcass is six weeks to two months, and the most desirable live weight is 140 to 175 lb. Top veal calves usually sell at about the same price as top grain-fed beef cattle. There is then a wide range in price down to *cull veal* calves, which bring only about one-third as much per pound as the best. Many dairymen send calves to market at very young ages and take whatever they can get for them because they believe it does not pay to feed the necessary amount of milk to make them into desirable vealers. If a veal calf is kept too long and gets too big and heavy the price is lower per pound; it thus does not pay to keep even the best calves any longer than necessary to make them into desirable vealers.

FIG. 236 A large tank truck used by a dairy cooperative in Michigan to collect and transport milk to Detroit (*Michigan Milk Producers' Association.*)

Selling Milk. The sale of milk or its products from the dairy farm may be a simple or a complex procedure according to the plan followed. Most dairy farmers sell either whole milk or cream in bulk to distributors and creameries or through a cooperative distributing agency or creamery. Others distribute the milk and products made from it themselves. The latter plan is followed principally by dairymen located close to small or medium-sized towns. Distribution of milk and processing of butter, cheese, and ice-cream products in large cities is best handled by specialized distributors, processors, or cooperative organizations (see Fig. 236).

If the dairyman decides to sell whole milk in bulk, there are usually

only one or two satisfactory outlets for his product. Usually it is a matter of taking it to a shipping station for transportation to a large city. In areas near large cities, milk trucks are often sent out from the central distributing plant to pick up the milk from the farms in 10-gal. cans. Special tank-type trucks are used for transmitting milk from local concentration points. This method is also coming into use for collecting milk directly from dairy farms. The production of milk for this purpose requires cleanliness in milking and in handling the milk and prompt cooling of it after milking in order that it may be kept

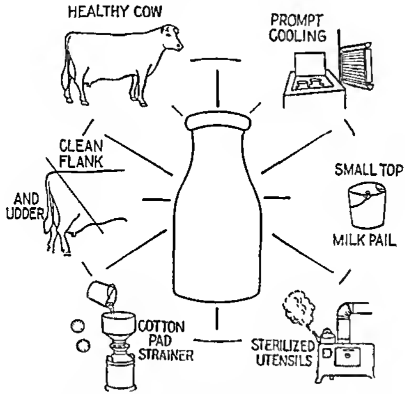


FIG. 237. Cleanliness in producing milk and prompt cooling are necessary for a high-quality product. (*Michigan State College.*)

sweet, wholesome, and sanitary, as shown in Fig. 237 (see also Chap. 5). If cream is sold in bulk, the same practices must be followed, with the task of putting the whole milk through the separator added. The marketing of whole milk and cream in bulk can be done effectively by cooperative marketing organizations, and much of it is marketed that way.

If the dairyman decides to distribute his milk and other dairy products to the consumer, he will need a suitable milkhouse, equipment for bottling, and equipment for making any other products that he may find it profitable to supply to his customers along with the whole milk.

5. Marketing Beef Cattle

To a very large extent, the production of beef in the United States is carried on in two ways. About one-fourth of the beef calves produced are raised on ranches of the West. When ready to be fattened for slaughter, these calves are marketed as feeder animals. They are purchased by farmers and specialized cattle fatteners in areas that produce

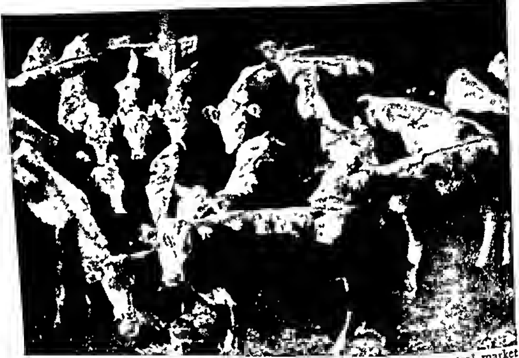


FIG 238 Good to choice Texas-raised, yearling feeder cattle at a central market ready for shipment to a Corn Belt farm for fattening (*A M Wettach, Iowa*)

surplus corn or other grain, where they are fattened and then sold for slaughter. Many beef calves raised on farms to the feeder age are also sold to be fattened on other farms. There is also considerable trade in beef cows and heifers as breeding stock, though much of this trade does not reach the central markets. Old cows and bulls from beef cattle herds are usually marketed when no longer useful without any special preparation or feeding before being slaughtered.

From dairy herds, most of the calves that are not grown out for breeding use are marketed as veal. Discarded bulls and worn-out cows are sold on the beef markets with little or no special fattening. Some dairy-bred bull calves are made into steers and grown out along with

the heifers to the age of one or two years, when they are usually sold for immediate slaughter. At times such dairy-bred heifers and steers may be purchased as feeders and fattened before selling for slaughter. There is also considerable trade in dairy-bred heifers and cows for use as breeding cows or milk cows.

The cattle pens on any large market usually contain a wide variety of cattle of all ages, many types, and in all degrees of finish, from extremely thin to very fat. The price range for any day's run usually varies considerably per pound between the highest and the lowest price paid. For example, it is not unusual for the poorest cattle in the day's run to bring as little as 10 cents per pound and the best ones 30 cents or more per pound.

Classing and Grading Cattle. It can readily be seen that one essential to dealing and particularly to an accurate market report for such a mixed group of cattle would be a set of classes and grades with descriptive terms easily understood by all persons concerned with the selling and buying of the cattle. Such a set of classes and grades has been developed and is in use on all large markets and by all market reporting agencies.

The Market Classes. The first step in the classification of cattle is the use of the two terms, *cattle* and *calves.* This division is based on age. All members of the cattle family are called "calves" until they reach the age of one year, after which they are designated "cattle." Cattle and calves are then each divided into three groups, based on the use that they will serve, and each group into a number of classes based on sex conditions. The following outline shows this division into groups and classes:

Cattle	Calves
Slaughter cattle	Vealers
Steers	Slaughter calves
Heifers	Steers
Cows	Heifers
Bulls	Bulls
Stags	Stocker and feeder calves
Stocker and feeders	Steers
Steers	Heifers
Heifers	Bulls
Cows	
Bulls	
Milkers and springers	
Milkers	
Springers	

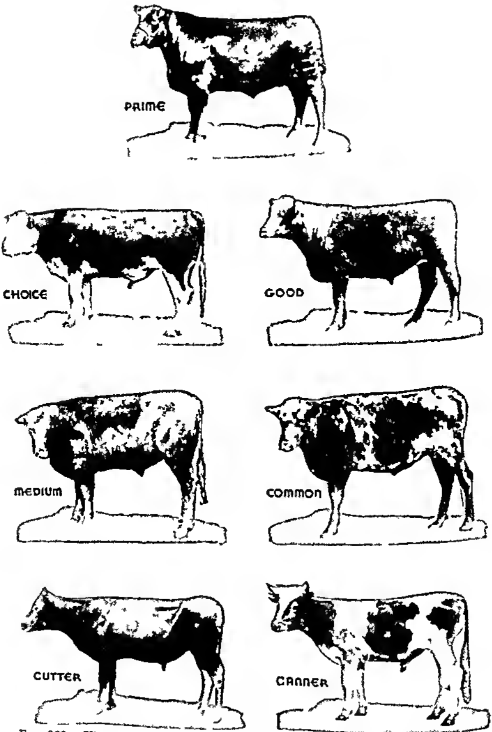


FIG 239 The market grades of slaughter steers Since Jan 2, 1951, the above grades of prime and choice became prime, the good became choice, some of the medium became good and the rest commercial and the common became utility (*Agricultural Marketing Service, U.S Department of Agriculture*)

The slaughter cattle group includes all cattle sold for immediate slaughter. The stocker and feeder group includes those sold to be grown for a time or fattened. Cows and heifers that might be purchased for breeding use are commonly referred to as "stock" cows or

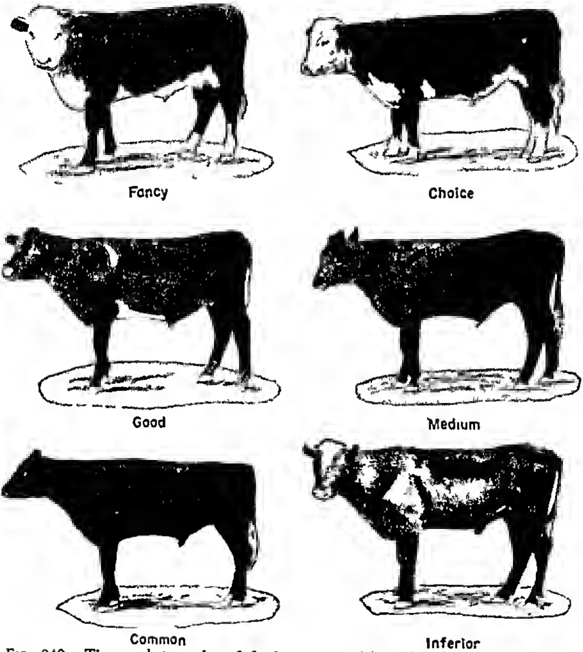


Fig 240 The market grades of feeder steers (*Agricultural Marketing Service U.S Department of Agriculture*)

heifers. Milkers and springers include those cows recently freshened or soon due to calve, sold for use as dairy cows

The vealer calf group includes those calves which have been fed only on milk and are sold for immediate slaughter. The slaughter calf

group includes all calves that have received feed besides milk and that are sold for immediate slaughter. Stocker and feeder calves include those sold to be grown or fattened. The veal calf class is composed largely of the younger, smaller calves under three months old. The slaughter calf group is composed of older, heavier calves, and the stocker and feeder group is composed of calves that have reached weaning age and are ready to go on a growing or fattening ration.

Further division of the several market classes is often made in dealing and in market reporting. Cattle falling within a class may be further grouped according to age or weight or both. In market reporting, quotations are always given according to market class or sex condition, and according to age and weight for those classes in which a wide range in age and weight may affect the suitability of the animal for the purpose it is to serve. In dealing, slaughter steers are commonly divided into two age groups, yearlings and two year olds or over. This age grouping applies also to slaughter heifers, slaughter bulls, and stocker and feeder steers and heifers. Each class and age group is then commonly divided into two or three weight groups, the weight range often being specified by stating the range in weight allowed, though sometimes the terms *light, medium,* and *heavy* are used without giving the range in pounds. Stating the age grouping or the weight grouping, or both, in preparing a market report is necessary only for those classes in which the approximate age or the approximate weight of the animal will influence the price.

The Market Grades. After cattle have been divided into groups and classes according to the immediate purpose they will serve to best advantage, as determined by their sex, condition, approximate age, and weight, the groups are graded or divided still further on the basis of the degree to which they fulfill the requirements of their group and class. The following list of terms is used to distinguish the several grade groups:

Slaughter Grades	Stocker and Feeder Grades
Prime	Fancy
Choice	Choice
Good	Good
Commercial	Medium
Utility	Common
Cutter	Inferior
Canner	

Conformation, finish, and quality are the factors which largely determine the grade or degree to which an animal fulfills the requirements

of its class. In the slaughter classes, finish, form, and quality are of importance in the order given. In Fig. 239, the slaughter grades are shown. In the stocker and feeder classes, form is of the greatest importance, quality next, and finish is comparatively unimportant. The grades for stockers and feeders are shown in Fig. 240.

Nearly anyone with a very little training could go into a pen of cattle and classify them into the groups and classes given on page 455. Grading, however, requires considerable skill; only after considerable practice under the guidance and instruction of an expert can one become proficient in this final task in the classification and grading of cattle.

FIG 241 Students of vocational agriculture identify the grades of feeder calves in a national contest

Using Market Classification and Grading as a Guide in Marketing Beef. Perhaps the most important use the livestock raiser should make of a knowledge of market classes, grades, and market reports is as a guide in planning his enterprise. This should be operated in such a way that animals produced in his herd may be offered for sale in the most attractive condition under the production plan being followed and, in so far as possible, at the time when they are likely to sell at the highest price. The time of year to sell and the age and condition in which to sell heifers and steers are determined, to a large extent, by the kind of enterprise the cattle producer is engaged in. For example, the rancher of the Northwest finds his logical marketing season to be the fall of the year toward the close of the grazing season.

Factors influencing production costs require selling range cattle at the ages and seasons of the year when they can be marketed with low production costs charged against them, rather than when they might be sold at the highest price That is, giving attention to production costs contributes more toward final net profit than trying to sell at the maximum price by marketing out of season This same principle holds true in raising and marketing several other kinds of livestock Likewise, the absence of grains suited to fattening cattle and the high cost of bringing such feeds to a ranch require that animals raised on the ranch be sold either in feeder or *grass fat* condition rather than as grain fat animals, even though they must sell at a lower price per pound The Corn Belt beef-cattle raiser, on the other hand, usually has corn available on his own farm or can purchase it from nearby sources He can usually increase profits by fattening the steers and heifers that he raises, thus selling them at the highest obtainable price per pound as *grain fat* cattle

The cattle that must be marketed as thin cattle from ranches and farms on which feeds suited to fattening are not available are purchased by men who make a specialty of fattening thin cattle Whether a farmer is fattening steers or heifers he has raised or cattle he has purchased to fatten, the largest profit is usually secured if such cattle are made fat enough to suit the most exacting meat trade before they are sold Beginning cattle fatteners are more likely to send cattle to market before they are fat enough to command the top price than they are to keep them too long and let them become overfat Part of the profit from the fattening of cattle on grain frequently comes from increasing the value of the original weight of the animal at the beginning of the fattening period by 2 to 5 cents per pound Unless cattle are made fully fat, this increase in value, or *margin*, as it is commonly called, will not be secured (For a further discussion of margin, see Chap 2) Many beginning cattle fatteners have been disappointed after buying thin cattle, feeding them awhile, then sending them to market to find that they sell for about the same price per pound they paid for them In most instances, all that was wrong was they either did not feed grain liberally enough or did not keep the cattle long enough Unless one feels certain of his ability to determine when his cattle are fat enough to fulfill the requirements of the good and choice grades, one is wise not to sell until he has had them looked over by someone who knows

Many cattle such as discarded bulls, cull cows, and veal calves sell to best advantage whenever they are no longer useful, regardless of the

prevailing price. This is true because carrying costs on such animals increase faster than the probable increase in value. It is especially true of veal calves, which if not marketed at the proper age and weights, will soon sell as slaughter or feeder calves at a lower price per pound.

Thus, it is seen that, while every effort should be made to market cattle and calves in such a manner that they will fulfill the requirements of those market classes and grades that bring the highest prices, production costs often enter into the problem and marketing must be in keeping with low production costs rather than in terms of what will secure the highest selling price.

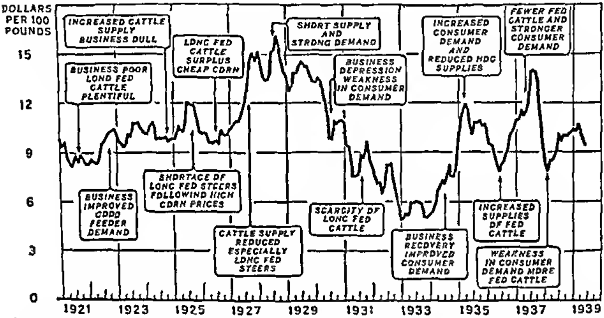


FIG 242 Chart showing variations in market price of beef steers through the period 1921 to 1939, with principal factors that influence price variations noted on the chart As shown by the chart the principal factors are (1) the market supply of cattle, (2) consumer incomes, (3) prices of competing meats, and (4) the demand for stocker and feeder cattle. (*U.S Department of Agriculture*)

Using Production and Price Cycles as a Guide in Marketing Beef Cattle. The influence of production cycles on livestock prices generally has been discussed earlier in this chapter. It should be kept in mind that the typical length of the production cycle for beef cattle is about 17 years, as shown in Fig. 228. The cattle raiser should always keep his eye on his probable position in the production cycle, endeavor to sell heavily, cull, reduce inventory on the approach to or at the high points in the price cycle, and then build up again while prices are low. Too many cattle raisers are always increasing numbers about the time the price cycle is nearing its peak. Since the decline is rapid once the

peak has been passed, they usually find themselves selling heavily at the low point in the cycle. In fact, it is that sort of response of cattle raisers to prices that makes the production and price cycles.

Controlling Shrinkage in Weight. Although they are usually fed and watered at the market before they are sold, cattle often weigh less at the market than when they are started from the farm or ranch. This difference, or loss in weight, is called *shrink*. It may be due entirely to a decrease in amount of material in the digestive tract, or it may include some actual shrinkage of the tissues. Weight changes may vary from

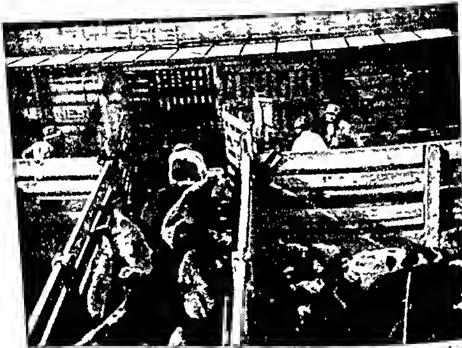


FIG 243. Cattle being loaded into freight cars in a local stockyard for shipment to a central market The cattle are being carefully driven up a well-built loading chute, thereby avoiding injury (*National Livestock Loss Prevention Board*)

an actual gain in weight following a short haul to market on a warm day, when the animal will take a large fill of water at the market, to a shrink as high as 10 per cent following a long haul to market in cold weather. The average shrink for hauls up to about 500 miles is 3 to 4 per cent.

Sometimes, selling agencies emphasize their ability to secure big fills and minimum shrinkage as an important item in marketing. In reality, the only sound reason for feeding and watering cattle after they arrive at a market to be sold for slaughter is the humane one to keep them from suffering the pangs of hunger and to prevent an increase in tissue

shrinkage due to restlessness caused by hunger. Naturally, buyers are not able to estimate with perfect accuracy the dressing per cent of each lot of cattle they buy, but they must be able to get within about one-half of 1 per cent of the dressing per cent on the day's buy. That is, they must always be on the alert for cattle with a large fill and bid for them according to the fill they have. It is doubtful, therefore, if heavy fills and light shrinks mean any more money to the seller than light fills and large shrinkage.

Controlling Bruising and Injury. Perhaps of greater importance than the amount of fill obtained at the market is the amount of bruising and injury suffered by cattle by shipping them with horns on them; by shipping large and small animals in the same truck or car without protecting the small ones by partitions; by overloading or underloading; and by unnecessary rough or careless handling in driving, loading, unloading, sorting, and weighing. Every year, many thousands of dollars are lost to cattle raisers because of the trimming out of bruised spots and the reduced price at which the bruised carcass must be sold. It is impossible for buyers to detect bruises in the live animal, but an allowance to cover bruises must be made by all processing companies in setting the spread between the buying and selling price. An animal that is killed or crippled en route to market is a loss to the shipper. The loss from dead and crippled and bruised animals could be greatly reduced by more careful handling all along the line from the farm or ranch to the slaughter pen.

6. Marketing Sheep and Wool

The marketing of sheep resembles in many respects the marketing of beef cattle. As in beef production, lamb production is to a large extent carried out in two phases. Lambs are raised to feeder weights of 50 to 70 lb. on ranches, then sold to farmers and specialized lamb fatteners, who put them through a fattening period of 80 to 120 days and sell them as fat lambs ready for slaughter. Again, as with beef cattle, many breeding flocks of sheep are also maintained on Corn Belt farms and in small-grain areas, where the lambs are carried through the fattening period on the same farm on which they are raised.

Generally speaking, the factors that influence the prices for beef cattle also determine the prices for sheep. The amount and quality of wool carried by a sheep or lamb at marketing time influence the price to some extent. Other factors being equal, the larger the amount of wool on the sheep at the time of marketing, the higher the price per

pound at which it will sell. The wool is usually worth about three times as much per pound as the live weight value of a typical slaughter lamb.

Classing and Grading Sheep. In classifying sheep, account is taken of the fact that many ewes are sold each year as breeding ewes. They often sell for less money per head than fat ewe lambs. As a result, some lamb raisers prefer to sell the ewe lambs and buy older ewes rather than to keep

Fig. 244. These fat lambs at a market show in Michigan were raised by students of vocational agriculture. They are being graded by a market expert and prizes are given on the basis of market grade. They were sold the following day on a central market.

the ewe lambs for replacements. In classifying sheep, they are first divided into two groups, *sheep* and *lambs*. A young sheep is called a lamb until it is about twelve months old. The market classes of sheep and lambs are listed below.

Sheep	Lambs
Slaughter sheep	Slaughter lambs
Ewes	Spring lambs
Wethers	Ewes and wethers
Rams	Rams
Feeder sheep	Feeder lambs
Ewes	Ewes and wethers
Wethers	Shearer lambs
Breeding sheep	Ewes and wethers
Ewes	

During seasons of the year when the lambs appearing on the markets are approaching twelve months old, their classification as lambs or yearling sheep is often determined by an examination of the teeth. The young lamb has four pairs of incisor teeth on the lower jaw and none on the upper jaw. The first set are temporary, or lamb, teeth. At the age of about one year, the center pair of incisor lamb teeth is replaced by a pair of larger, broader, permanent teeth. If this center pair of permanent teeth is showing about fully developed, the animal in question is classed as a yearling. If the lamb teeth are all present, it is classed as a lamb. The condition of the teeth as an indication of the age of older sheep is also extensively used in dealing in breeding ewes. The first pair of permanent incisor teeth appears at about one year, the second pair at two years, the third pair at three years, and the fourth, or corner, pair at four years. The age of the breeding ewe affects her value materially; therefore, ages are generally carefully checked in dealing in breeding ewes (see Fig. 55, page 86).

Several of the terms used in classifying sheep need to be defined. A *wether* is a male sheep that was castrated as a young lamb. By a *spring lamb* is meant a young lamb, weighing usually 60 to 85 lb., that is fat and ready for slaughter. The term is used principally during the spring months. Lambs classed as spring lambs are born from about December to February. They begin to appear on the markets in late April, when most lambs from the previous year's crop are approaching the twelve-month age limit. At this season of the year, many consumers are willing to pay a higher price for the meat of the younger lamb—hence the need of a class to distinguish the young lambs of the new crop from the older ones remaining from the previous year's crop. Later in the season, after all the lambs from the previous year's crop have been marketed, the spring lamb class is dropped until the first ones appear again early in the following year.

The term *shearer lamb* is a class name used principally during the late winter and spring months to indicate a lamb that carries nearly a full year's growth of wool but is not yet fat enough to be a market-topping slaughter lamb. Such lambs are often purchased by men who take them to feed yards near the market, shear them, feed them until they are fully fat, then send them back to market as fat, shorn lambs. The term *shorn lamb* is used to indicate that the lamb in question has had its fleece removed within about 2 months from the time of its appearance at the market. In dealing and in market reporting during the spring of the year,

the terms *shorn* and *wooled* should be added to the class names to indicate whether the price being quoted is for shorn or unshorn sheep and lambs The shearer lamb is always one with the wool on

After sheep and lambs have been classified according to the above classification table, they are further divided according to age and weight The terms *light*, *medium*, and *heavy* are used extensively by sheep and lamb buyers and salesmen instead of giving the weight range, though in market reporting the approximate weight of the class and grade on which a price is quoted is usually given As with barrows and gilts in classifying hogs, ewe and wether lambs are grouped together because the sex difference does not affect their carcass or feeder value

The following are the grade terms used in grading sheep and lambs

Slaughter Sheep and Lambs	Feeder Sheep and Lambs
Prime	Fancy
Choice	Choice
Good	Good
Utility	Medium
Cull	Common
	Inferior

To the inexperienced hand, the grouping or sorting of sheep into market classes and grades might appear to be an impossible task, for the long growth of wool with which sheep and lambs are covered during most of the year makes them all look much alike Often it is necessary for the experienced salesman or buyer to get his hands on a sheep or lamb to determine the degree of finish or amount of fat, it has This is done by most experts by shaping the thumb and forefinger to resemble a V and placing them firmly over the backbone and ribs just behind the shoulder Some like to grasp the dock, or stub of the tail, in the same manner The thickness or width, behind the shoulders is an indication of the amount of muscle covering while the filling about the tailhead indicates principally degree of finish, or amount of fat The various slaughter grades are shown in Fig 245

Using Production and Price Cycles as a Guide in Marketing Sheep and Lambs. Since about 1890, the number of sheep raised in the United States each year has fluctuated less from a cyclic viewpoint than is the case with either beef cattle or hogs Nevertheless, sheep production and prices do follow a cyclic pattern As a rule, the sheep raiser with the small flock pays little attention to the cyclic trend The rancher with a large ewe flock will do well to keep informed as accurately as he can concerning the probable position he is in on the production and price cycle He may find it possible then to reduce num

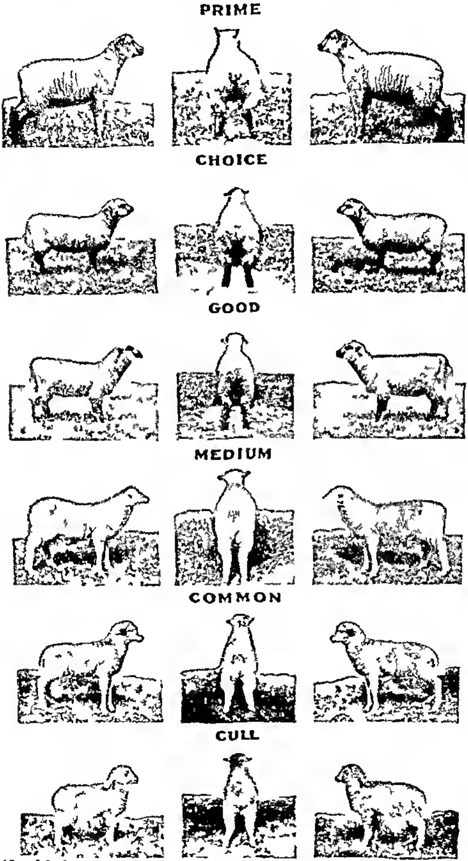


FIG 245 Market grades of slaughter lambs Since Jan 2, 1951, the grades of slaughter lambs are prime, choice, good, utility, and cull Note three views of each lamb (*Agricultural Marketing Service, U.S. Department of Agriculture*)

bers in high price periods and expand again during low price periods.

The rancher who raises a large number of sheep must also keep informed concerning the condition of the wool market. About one-third of the gross income obtained from a flock of range sheep is secured from the wool produced by the ewes, while in farm flock production the wool normally provides only about one-fourth of the gross income. The price cycle for wool generally follows the price cycle for sheep rather closely, but it does diverge somewhat at times.

Controlling Shrinkage in Marketing Sheep and Lambs. Sheep and lambs normally show a higher percentage shrink en route to market than beef cattle or hogs. A shrink of 4 to 5 per cent is normal even for a short haul to market. A shrink of 8 to 10 per cent is not unusual on a long haul. Sheep and lambs are timid animals. They are excited and frightened by handling and by the movement of the truck or freight car in transit. Often they refuse to eat or drink upon arrival at the market. Not much can be done to avoid this heavy shrink except to handle sheep as quietly and carefully as possible in marketing them. Use sand for bedding the truck or freight car in which sheep are to be shipped.

Controlling Bruising and Injury. Sheep are easily bruised and are subject to one type of injury not found in cattle or hogs. This is the bruise or inflamed spot developing on the flesh as a result of grasping a sheep by the wool to catch it or lift it into a truck. Such spots will show on the carcass if the sheep is slaughtered within 3 or 4 days after such handling.

If badly frightened, sheep may pile up in a car and some may be smothered. Smothering of weak lambs or ewes may also result from overloading. The use of good judgment and common sense in handling and transporting should eliminate nearly all loss from bruising, injury, and smothering of sheep or lambs en route to market.

Marketing Wool. As previously stated, the sale of the wool clip should comprise one-fourth to one-third of the gross annual income from the flock. Usually the wool is shorn soon after the ewes have lambed. In Southern states, shearing is done in March and April; in Northern states, in May and June. Average yields of wool per ewe vary from a low of 4 or 5 lb. of wool from inferior flocks to a high of 14 to 15 lb. from the best wool-producing flocks. Most sheep produce a fleece weighing between 7 and 9 lb.

Wool is one agricultural commodity that has never been produced in the United States in sufficient quantity to supply the demand. For

some years, total annual production in the United States has ranged between 300,000,000 and 400,000,000 lb., but in recent years, this has fallen to less than 300,000,000 lb. Annual imports of wool have varied between 100,000,000 to over 800,000,000 lb. Because wool is available for import to the United States in large quantities, the United States government has seen fit to protect American wool producers by an import tariff during most of the history of the country. Wool in the fleece usually brings to the producer a price somewhere between 50 and 90 cents per pound. The import duty on foreign wool

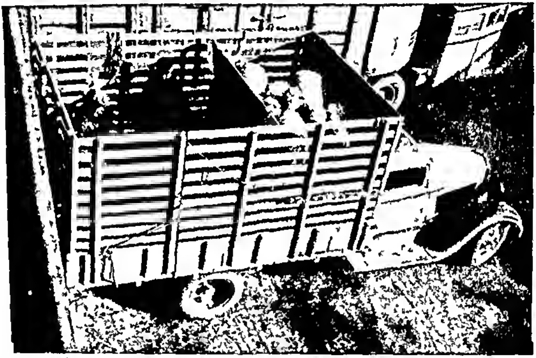


FIG 246 Lambs properly loaded in a mixed truckload of livestock (*National Livestock Loss Prevention Board*)

has usually been about one-third of the price for which domestic wool sells.

Market Classes and Grades of Wool. Dealing in wool has long been carried on according to a set of market classes and grades. Classes and grades were developed in several of the leading wool markets of the world many years ago. The terms used in describing the different classes and grades vary widely in different countries and in different markets in the United States. In 1917, when the U.S. Department of Agriculture began its study of market classes and grades of livestock, the study included market classification and grading of wool. A set of classes and grades was later set up and recommended to the wool trade in the United States for general use in 1926. This set of classes and

grades has been quite generally accepted and is used in dealing and in wool-market reporting throughout the country.

This set of classes and grades is in reality two sets. It combines the English grades, which are given in numbers, and the established American grades, which are expressed in words. Both lists of grades are given here because part of the American wool trade insists on using the American grades, even though part of the trade has adopted the English numerical grade. The fineness of the wool is the principal basis for grading by both methods. In the American method, it is assumed that the finest wool comes from sheep representing pure breeding of the fine-wooled type. The coarser wools are then called "half blood," "three-eighths blood," and "quarter blood." In the early history of sheep raising in the United States, the fractions supposedly indicated the percentage of fine-wooled breeding in the sheep that produced the wool. The fractions have lost their original meaning and no longer indicate in any way the breeding of the sheep. A fleece from a purebred Shropshire sheep may be graded as a quarter-blood or a three-eighths blood fleece. The fractions indicate to the experienced wool grader or dealer the degree of fineness of the wool. Because they became so thoroughly established through long usage it has been impossible to persuade the wool trade to drop them entirely and replace them with the numerical grades, though it is recommended by the U.S. Department of Agriculture that this be done.

The numerical grades are based on fineness of the wool as indicated by the number of hanks of yarn that can be made from 1 lb. of scoured, combed wool. A hank of yarn is simply a string 560 yd. long. In spinning yarn, the finer the wool fibers, the longer the string of yarn that can be made from 1 lb of wool If wool is graded 60's, this means that the grader expects that 60 hanks of yarn can be made from one clean pound. If it is graded 40's, this means that he believes that only 40 hanks can be made from one clean pound. In its simplest form the following is the list of grade terms or numbers commonly used:

American Grades	English or Numerical, Grades
Fine	80's, 70's, 64's
Half blood	60's, 58's
Three-eighths blood	56's
Quarter blood	50's, 48's
Low quarter blood	46's
Common	44's
Braid	40's, 36's

Besides being graded for fineness, wool is classified as *combing* or *clothing* on the basis of length. To class as combing, fine wool must be about 2½ in. long. The shorter wools are called clothing wool. This division is based on the manufacturing process that must be used in processing wool. Fine wool 2½ in. long or longer is combed before it is used, while wool less than 2½ in. long is *felted*. Felting means tangling the wool fibers together. Many other terms are used in describing wool to indicate its condition; among them are: *bright, semibright, burry, chaffy, pulled, domestic, territory, fleece,* and other terms, all of which have a meaning to the experienced wool grader or dealer.

Wool-market Reports. A daily wool-market report is prepared and made available by the U.S. Department of Agriculture, Market Reporting Service. It is in turn made available to the public principally through woolen-goods trade journals and sheep producers' journals. Many daily papers carry a brief wool-market report once or twice each week. Some print the wool-market report each day, along with their livestock-market report.

Preparing Wool for Market. Assuming that the sheep raiser has given proper emphasis to the importance of wool in the selection of breeding stock, he can do most toward obtaining the maximum return for wool by preparing it for sale according to market requirements. The starting point in accomplishing this is to keep the wool free of burs and chaff by proper care of the sheep through the year. Wool that is filled with burs or chaff is discounted heavily by the buyer. The second step is to exercise care in shearing and tying the fleeces. In large flocks or at shearing stations, wool is usually sorted by grades and sacked for shipment. This sorting must be done by an expert, experienced grader. In small flocks, each fleece is kept together by folding it into a strip about 15 in. wide, cut side out, then rolling into a moderately firm roll and tying with paper wool twine, as shown in Fig. 168. The fleeces are then packed into large burlap bags that hold 200 to 300 lb. of wool each.

Placing the sheep on a canvas or on a clean floor and then keeping this canvas or the floor clean are necessary. Filthy locks should he picked out of each fleece, not tied up with the wool. Shearing should be done only when the fleeces are dry; and if wool is to be kept for any length of time on the farm it must be stored in a clean, dry place. Damp wool will lose its luster and deteriorate greatly in value.

The sheep raiser who has a small flock and is inexperienced in shearing will usually be money ahead by employing a professional shearer

to do the shearing. . Professional shearers are available in nearly every community where sheep raising is a common practice. They nearly always furnish their own shearing machine and charge 40 to 65 cents per sheep depending on going wages and current prices of wool. Sheep shearing offers an opportunity to any farm boy who will master the technique to make good money by putting in a few days or a few weeks each spring serving neighboring sheep raisers as a professional shearer. To become proficient as a shearer, the reader is referred to

FIG 247 The grading floor of the terminal warehouse of a large cooperative wool-marketing agency The wool is being graded as it is received so that each producer receives a price based on the class and grade of his wool (*Farm Credit Administration*)

literature giving in detail the method of procedure. Skill will be acquired most readily by working a few days with an experienced shearer.

Selling Wool. In nearly every community, there is a local agency of some kind that will buy wool Local buyers may be dealers who buy with their own money and sell the wool again by consigning it to a commission firm on a large market or by selling it to a broker or directly to a manufacturer. The local agent may represent a manufacturer or broker, or he may represent a cooperative marketing organization.

The sheep raiser may sell directly to a manufacturer by shipping his wool to the warehouse of the manufacturer and taking the price the manufacturer puts on it. Many sheep raisers with large quantities of wool sell it in this way or consign it to a commission firm to be sold on commission. Because of its compact form and nonperishable character and the fact that all wool is ultimately purchased by a comparatively few manufacturers, wool is a product that is especially suitable for marketing cooperatively. A large cooperative wool-marketing agency has been developed in the United States through which practically any sheep raiser in the country can market his wool if he chooses (see Fig. 247).

7. Marketing Horses and Mules

The disappearance of horses and mules from city streets and from use in construction work has brought about a reduction in the country-wide network of horse and mule markets that existed during the period when nearly every person was dependent in one way or another on horses. During the period of increase in the numbers of horses, from about the year 1800 to 1920, there developed in the United States a large number of central horse and mule markets. Many were developed by the stockyard companies, and the selling of horses was carried on by commission firms who specialized in horses and mules. Many were located at points advantageous to the selling of horses and mules independent of the large livestock markets. Such horse and mule markets were supplied by dealers located in country towns, who purchased horses and mules and consigned them to the markets much as the drovers and livestock buyers purchased meat animals and consigned them to the central markets. A few of the large central horse and mule markets still persist, as do a limited number of men who still make a business of buying horses in local communities and consigning them to the markets. The trade in horses and mules is largely seasonal. Since most horses and mules are wanted for farm operation, the season of heavy buying is always the 2 or 3 months preceding the planting season for farm crops.

Most localities now are without the service of a local horse and mule buyer. The principal method of selling horses and mules at present is by direct dealing between neighboring farmers, one of whom has an extra horse or two to sell, the other needing an extra horse or two.

Selling Work Horses. Work horses are one of the kinds of animals that are brought to local auction markets to be sold. This method of selling may increase in the future if the local auction markets gain in favor.

Horses are always sold by the head. At large markets, they are often sold by auction. However, it is generally understood that at a horse auction the animals sold are protected by a list price and that if they do not bring the list price they may be returned to the barn unsold.

At present, one seldom sees any sort of report of prices prevailing for horses or hears a horse-market report over the radio, the reason being that volume in trading in work horses and mules is not broad enough to demand market reporting by interested agencies. Anyone interested in informing himself concerning prevailing prices must make special inquiry at points where a considerable number of horses is being sold.

No standard set of classes and grades is in general use in dealing in horses. A few large markets do put out reports based on descriptions in more or less general use in the area in which the market is located.

Selling Light Horses. The breeding and sale of saddle horses and race horses is a highly specialized enterprise, though in some communities light horses are produced by farmers owning only one to three or four mares. Many such mares are used to do light work on farms. The colts then are purchased by dealers and resold to the light horse trade. Many owners of riding stables located in cities throughout the country serve as dealers in saddle horses. Some persons who specialize in training race horses serve as dealers in race horses and colts of race-horse breeding.

8. Marketing Purebred Animals

The producer of purebred livestock must be his own salesman. He must in some way attract and contact the purchaser and deal directly with him. He must decide upon the price at which he will sell. As a result of this situation, the breeder of purebreds who hopes to succeed financially must be a good salesman as well as a producer of good animals.

Many procedures in selling purebred animals have been developed. All of them may be classed under one of three selling plans: (1) sale by mail order; (2) sale by direct barter; (3) sale by auction. Sales by mail order are accomplished by advertising in livestock or farm journals, attracting inquiries, and finally closing the deal through cor-

respondence. This plan is used most in selling poultry, hogs, and sheep.

Sales by private barter are based on many methods of attracting the prospective purchaser to visit the farm of the breeder. Then, after the animals being offered for sale have been inspected, dealing is accomplished by discussing price directly. More purebred animals are sold by this plan than by mail order and auction combined.

The auction plan of selling is practiced extensively by breeders of purebred livestock. Its use requires that a considerable number of animals be offered at a given time and place. The number must be

Fig. 248. A typical scene at an auction sale of purebred beef cattle. Each animal is sold to the highest bidder. (*The Shorthorn World.*)

large enough to justify the expense of conducting the auction. In conducting an auction certain expenses are necessarily incurred. There must be seating space for the prospective buyers, an auctioneer must be hired, a catalogue printed, and the sale advertised. It is difficult to hold the expense of conducting a worth-while auction below about $400. Several times that amount is spent on many auctions. Somewhere between 40 and 80 animals is the number generally offered in a 1-day sale.

Comparatively few breeders of cattle or horses have a large enough

herd to hold a successful annual auction alone Combination auction sales by two or more breeders are sometimes the means of promoting an auction Consignment auctions are also promoted by district, county and state breeders' associations and by national livestock record associations There is therefore generally an opportunity for the small breeder to use the auction plan of selling if he chooses Prices paid at the better auction sales are usually reported in breed journals and other farm papers These sale reports come the nearest of any thing now available to providing a market report for purebred animals

SUPPLEMENTARY ACTIVITIES

1 With other members of your class report the methods of marketing followed in selling livestock or livestock products from the home farms or ranches Discuss the advantages claimed for each method

2 If possible, visit a central livestock market or other available market place and observe all market procedures as explained in this chapter

3 Using all market information available, attempt to predict probable market price trends for each kind of livestock during the coming year

4 Practice market classification and grading on any livestock that may be accessible

5 Visit a local creamery or dairy products processing plant and observe procedures in preparing products for marketing and the marketing method followed

6 With other members of your class bring wool samples from home or neighboring farms and classify and grade them Discuss the wool marketing methods followed on fellow students' home farms on which sheep are raised and suggest possibilities for improvement

7 With others in your class attend an auction sale of purebred livestock, and observe procedures Estimate ahead of time the price you would be willing to pay for each animal and check with actual selling price at the sale

8 Follow a carload of livestock in the marketing process from a local farm to the central market and observe as many of the steps as possible

9 Develop plans for marketing most effectively the products and animals from your livestock projects

10. Preparing and Processing Livestock Products for Home Use

ONE OF the opportunities to increase the net income from the farm or ranch on which livestock is raised is by providing many food items at low cost for the family living there. To take full advantage of this opportunity, the farmer must carry on a diversified livestock production program to the extent of maintaining a few milk cows, keeping a small flock of chickens, and raising a few hogs, although his major livestock enterprise may be extensive production in a single enterprise—beef cattle, hogs, or dairy cattle. Preparing and preserving livestock products for home use is discussed in this chapter under the following headings:

1. Making Plans for Using Home-produced Livestock Products
2. Preparing Pork and Pork Products for Home Use
3. Preparing Dairy Products for Home Use
4. Preparing Beef for Home Use
5. Preparing Veal for Home Use
6. Preparing Lamb for Home Use
7. Providing Cold Storage for Meat

1. Making Plans for Using Home-produced Livestock Products

Reducing Cost of Family Food Supply. The contribution of home-produced food items to the family table does not increase the gross income from the farm or ranch, but it does reduce the cash expenditure necessary for foods and in that way leaves a larger net income. This will hold true only when the food items are produced at a lower cost than the price at which they could be provided through purchase. On most farms and ranches, a variety of food products is made available at a somewhat lower cost by raising or maintaining the animals

producing them than when these products are purchased from retail meat shops or stores The amount of saving that can be made in this way varies with the cost of raising and keeping the animals and with the number of people to be provided with food

The fewer persons to be provided for, the smaller the advantage in keeping animals especially to produce products for home use This is due to the fact that the labor involved in caring for such animals and in processing and storing the products from them is about the same, whether there are only 2 or 3 persons at the table or 8 or 10 The

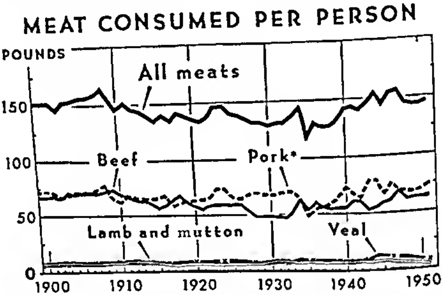


FIG 249 Trends in average meat consumption in the United States In recent years the average consumption per person was about 150 lb Of this amount 75 lb was pork over 60 lb beef and small amounts were veal and lamb (*U S Department of Agriculture*)

farmer with a small number of people at the table to be fed may wisely choose to purchase at least some of the food products needed instead of maintaining the animals that would be necessary for the purpose

Securing High quality Products With the constant improvement in the standard of living in rural homes, more attention is being turned to improving the diet and the quality of many food items on the family table Home produced foods are fresher, more appetizing, readily available, and usually higher in quality This applies, of course, to vegetables and fruits as well as to animal products In many rural homes, it is possible to provide high quality meats, fresh eggs and

poultry, and fresh milk, cream, and butter directly from the livestock enterprises conducted.

Preparing and Processing Livestock Products. During the 20 years from 1930 to 1950, an increasing number of families made use of facilities in the form of lockers in community cold-storage plants designed for the storage of meats and other perishable products. These are commonly called "refrigerated-food lockers" or "frozen-food locker plants." The advantages of the refrigerated locker are that the livestock raiser can slaughter his own animals and take the meat to the

FIG 250. Storage room in a refrigerated locker plant Meats and other foods are brought to the plant, quickly frozen, and stored in a rented locker Many farmers use the facilities of the community locker plant for storing home raised and home-slaughtered meats (*Michigan State College*)

locker plant, where it is "quick frozen" and conveniently stored. Thus, it is kept in excellent condition until needed. Members of the family go to the plant at their convenience and remove items of food from their locker as they are needed.

Another development of recent years is the home freezer unit for installation on the individual farm or ranch. Such units are suitable for freezing various foods, including animal products, and for the storage of the frozen foods until used. A further discussion of cold storage for animal products will be found at the close of this chapter.

Planning on Basis of Family Food Requirements. Each family should plan carefully its food needs in order to provide well-balanced

s for the persons in the family group The data in Table 52 are pful in determining the amounts of various livestock products neces- y and the numbers of livestock required to provide them In using information keep in mind that the proportions of the various kinds lean meats may be varied considerably according to the tastes of family and the facilities for providing certain products

BLE 52 NUMBER OF LIVESTOCK NEEDED TO PROVIDE LIVESTOCK PRODUCTS FOR A FAMILY OF FIVE*

Kinds of products	Amount needed per year for family of five	Head of livestock required
Milk (drinking and cooking)	450 gal	Two cows freshening at different seasons
Butter	150 lb	
Lard	60 lb	(Hogs as shown below)
Eggs for table use and cooking	150 doz	30 to 40 layers
Lean meat (as listed below)	650 lb (total) †	Provided as follows
Poultry	170 lb †	50 to 100 chickens (depending on size) including those in laying flock used also for meat
Pork	250 lb †	Two hogs averaging 225 lb live weight (for meat and lard)
Beef	200 lb †	One young beef or part of larger beef
Lamb	30 lb †	One lamb or less

* Adapted from data from U.S Department of Agriculture.
† Amount that reaches kitchen exclusive of losses in slaughter

2 Preparing Pork and Pork Products for Home Use

Hogs are more often butchered on the farm in providing meat for the family table than are cattle or sheep Because the slaughtering of the hog involves so little waste, it is a more economical practice than is the home slaughter of cattle or lambs Slaughtering a hog is also less difficult than slaughtering and dressing out a beef animal The meat of the hog can be easily cured and stored, and the fat or lard can be rendered and stored, all without refrigeration Beef and lamb carcasses must be kept at a low temperature or used within a few days following slaughter

Slaughtering and Dressing a Hog Although many hogs are slaughtered and dressed on farms with very little equipment, it is recommended that attention be given in advance to providing the necessary equipment.

The task will then prove simpler and less unpleasant. Provide several butcher *knives,* at least two bell-shaped hog *scrapers,* a sharpening *steel,* a large meat *saw,* a hog *hook,* a *thermometer,* and a *gambrel.* Most of these tools are shown in Fig. 251. Include in the equipment a strong *table* of open-slat construction about 2½ or 3 ft. high, 5 ft. long, and 4 to 5 ft.

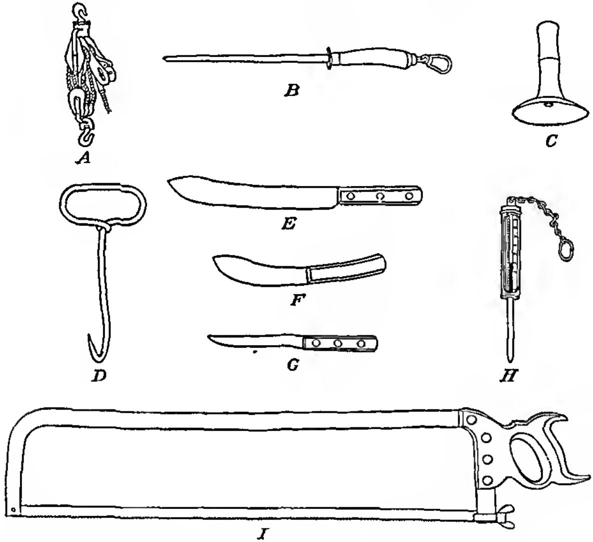


FIG. 251. A good set of butchering tools includes: (*A*) block and tackle, (*B*) sharpening steel, (*C*) bell-shaped scraper, (*D*) hog hook, (*E, F,* and *G*) three types of knives, (*H*) thermometer, and (*I*) meat saw.

wide. A hog crate turned on the side makes a fair substitute for a table. The hog is placed on this table to remove the hair after scalding. The open-slat construction allows the water and hair to drop through and helps to make a cleaner job of handling the hog. Have a barrel or tank adjacent to the table for scalding the hog, as shown in Fig. 253. There must be some provision for heating the water for scalding. This can be done on the kitchen stove, in a large kettle near the butchering layout,

or in the scalding tank so arranged that a fire can be built under it Provide some means of pulling the hog out of the water and also up by the hind legs for later removal of the entrails and allowing the carcass to cool

Killing and Bleeding Sticking is best done with a slightly curved, sharp pointed knife about 8 in long Success in bleeding is most certain if the sticker has someone hold the hog flat on its back while he stands in front and inserts the knife just in front of the breastbone or at the point that would appear to be the center of the hog's throat Keep the knife

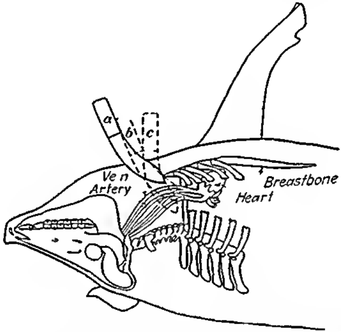


Fig 252 Many thousands of hogs are slaughtered on farms each year Success in this work begins with proper and thorough bleeding of the animal The three positions of the knife in the bleeding operation are shown (*a*) the initial cut, (*b*) the knife in position above the artery (*c*) the final position after the downward thrust has been made and the artery severed (*U.S Department of Agriculture*)

pointed toward the tailhead of the hog, push it in about 7 in, and then give a quick downward thrust This should sever the arteries in the neck and cause the hog to bleed freely (see Fig 252)

Scalding and Scraping After sticking, allow 5 to 7 min for complete bleeding During this time, place the water in the barrel or tank, and adjust the temperature within 3° of 150°F The best scalding job is secured at a water temperature of exactly 150°F Several tablespoonfuls of lye placed in the water help to loosen the hair and scurf on the skin If a barrel is used, put one end of the hog in first, then reverse and scald

the other end. Keep the hog moving and turning while being scalded; otherwise, the parts in contact with the barrel will not be properly scalded. Scraping must be done quickly while the skin of the hog is still warm, to prevent "setting" of the hair, which makes it necessary to shave it off. Experienced butchers determine when scalding is completed by "trying the hair." This means pulling the hog partly out of the scalding water and trying an area with a knife or scraper to see if the hair comes off easily. If it does not, the hog is pushed back into the water and given

FIG. 253 Temporary equipment for scalding a hog The table is used as a platform for scraping the hog carcass after scalding. *(Bulletin 187, Extension Service, Ohio State University.)*

a little more time. A good scald is secured ordinarily in about 3 min. time.

Pull the hog out onto the scraping table, and remove the hair from the legs first by rubbing and twisting around them with the hands. Then scrape the head as quickly as possible. These are the hard parts to get clean, especially if a poor scald has been secured. The hair usually comes off the smooth parts of the body easily by using a bell scraper. As the work progresses, it sometimes helps to pour a little hot water dipped from the scalding barrel over the parts hard to get clean.

Once the hair is removed as thoroughly as possible, hang the carcass and thoroughly wash it with cold water Slit the skin lengthwise on the rear legs below the hock and over the tendons for a distance of 3 to 4 in Free the tendons just beneath the skin with the fingers and a knife so that the hog gambrel or rod can be inserted under them If a cooling rack adjoins the scraping table as shown in Fig 254 and the animal is not too large, two or three men can lift the rear end of the hog high enough to get the gambrel over the bars Then the front end is just pushed off the table For large hogs, a block and tackle must be used to hoist them

Removing Entrails and Pluck Remove the entrails by cutting up through the breastbone from the opening made by sticking, then, beginning just below the aitchbone, cut down the middle line of the belly, being careful to cut just deep enough to get through the skin and flesh *Avoid puncturing the entrails* In large hogs use the saw if necessary to cut through the breastbone and the aitchbone Loosen the entrails from the rear by cutting around the rectum and pulling the end of the gut down through the pelvic arch into the abdomen Some cutting needs to be done to accomplish this Be careful not to cut the gut itself The entrails with a little careful pulling will then drop and roll out into the receptacle provided to receive them A wheelbarrow, washtub, or large metal basket is a suitable receptacle for this purpose Some cutting will be necessary to sever the gullet down below the breastbone

Remove the heart lungs and windpipe (called the ' pluck ') by cutting the diaphragm the membrane that separates these organs from the rest of the abdomen By cutting this membrane down along the ribs and backbone the windpipe is removed along with the heart, liver, and lungs Catch the pluck in another receptacle A dishpan is a suitable receptacle for this purpose The carcass is now ready to be washed on the inside with cold water Split it in half down the center of the back bone using a large meat saw

Most amateur butchers prefer to loosen the leaf lard (the thick collection of fat around the kidneys) while the carcass is still warm The head may also be removed at this time Cut it off just behind the ears after all the fleshy part has been severed, the neck bone is loosened by twisting the head in a circular fashion until it separates from the body The carcass is then ready to be left hanging until thoroughly cooled In slightly above or slightly below freezing weather, this will be accomplished in a few hours In very cold weather it may be necessary to put the carcass

in a protected place to prevent freezing of the outside before the inside is cooled *Do not allow the pork carcass to freeze.* Pork that has been frozen is likely to spoil during the curing process. In weather above freezing, 12 to 18 hr. will be required for thorough cooling.

Caring for Liver, Heart, and Head. As soon as the carcass has been washed after removing the entrails, pluck, and head, separate the edible parts of these organs First remove the gall bladder from the liver. Then separate the liver from the heart and lungs, and thoroughly wash

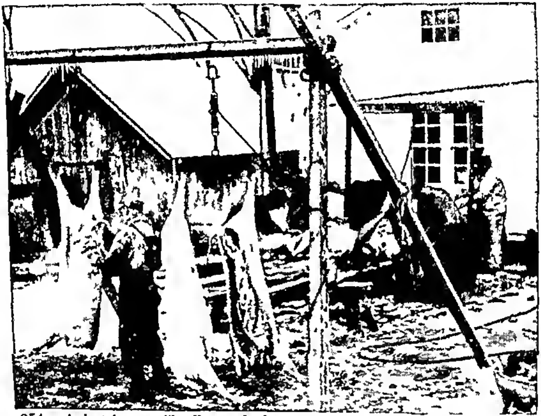


FIG 254. A butchering "bee" in which several farmers cooperate in slaughtering hogs for home use (*A M Wettach, Iowa*)

it in cold water. It may then be prepared and eaten as fresh liver or be made into sausage. The heart is given the same treatment and used in the same way. It should be opened with the knife and washed inside as well as outside. Discard the lungs. The head is prepared for use by laying it on a table face side down and cutting off the jowls, or cheeks, first. These may be cured or used in sausage. Trim all other meat from the head, and use for sausage. The tongue is removed and usually cured before being prepared for the table. Many persons like fried brains. If the brain is to be used, remove after sawing off the top of the skull.

Cutting the Carcass The side of pork should be cut in a cool room with the temperature of the meat down between 34 and 40°F Lay the side or half of the carcass on a table bone side up Remove ham and shoulder by cutting and sawing along the lines indicated on the chart in Fig 255 Trim hams and shoulders as neatly as possible as indicated in the chart If the shoulder is to be cured, leave it in one piece Place all fat trimmings in a receptacle to be rendered for lard and all lean trimmings in another receptacle to be made into sausage Separate the back from the belly, or bacon, by cutting lengthwise as shown on the chart The spareribs are trimmed out of the bacon strip, and the thick covering of fat is trimmed from the back piece The spareribs are used fresh, and the back fat rendered for lard The loin cut is used fresh for roasts and pork chops The ham, shoulder, and bacon are usually cured and smoked before eating even though they may be kept under refrigeration

Making Pork Sausage. One of the first tasks requiring attention after the pork carcass has been cut and trimmed is the making of sausage The simplest procedure in making sausage is to put the lean trimmings through a sausage grinder, then add ¼ lb of salt and 2 oz of pepper to each 50 lb of meat and mix thoroughly, using a large spoon, wooden paddle, or the hands Many prefer to use sage, garlic, or ginger to give further flavor to the sausage Add 1 to 3 oz of these materials to each 50 lb of sausage The sausage is then ready to be made into cakes and cooked as used or cooked and packed into open earthen jars for later use One of the simplest and most successful methods of preserving cooked sausage is to pour melted lard over it until the meat is covered by the lard The lard hardens as the contents of the jar cool If stored in a cool room, the sausage will keep in this condition for several months without refrigeration

There are many ways of making sausage, involving principally different proportions of lean to fat, the adding of other materials such as cornmeal, the use of still other flavoring ingredients, packing it in various forms of casings or containers, and sometimes curing and smoking the sausage

Rendering Lard. To secure a white, clean, wholesome appearing grade of lard, remove all small particles of lean meat from the fat trimmings The back fat and the leaf fat constitute the larger pieces of clear fat The skin need not be removed from the pieces of clear fat that are covered with skin Cut all pieces of fat trimmings into cubes about 1 in in size Then place the fat in kettles, and cook it until the cracklings

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

FRESH PORK CHART
WHOLESALE AND RETAIL CUTS

WHOLESALE CUTS – PERCENTAGE OF CARCASS

1-HIND FEET	1.00%	7-BRISKET	2.25%	⑫-JOWL BUTTS (TRIMMED)	2.25%
2-HAMS	19.00	8-PICNIC	7.50	⑬-BONELESS BUTT	3.05
3-CLEAR BELLIES	16.50	9-N.Y. STYLE SHOULDER	16.00	13-BOSTON BUTT	5.20
4-PORK LOINS	12.75	10-NECK BONES	.95	14-LOIN BUTT	4.00
5-SPARE RIBS (F.S.)	2.50	11-PICNIC BUTT	3.02	15 FORE FEET	.92
6-SPARE RIBS (N.S.)	1.50	12-JOWL BUTTS (UNTRIMMED)	3.75	16 LEAF FAT	3.52

FIG. 255. The location and name of the pieces or cuts into which a hog carcass is divided in preparing the meat for curing or cooking fresh. (*U.S. Dept. of Agriculture.*)

(skin pieces) turn brown and begin to float One way to tell when the lard has cooked enough is to lift some of the cracklings from the kettle and drain them, if the lard all seems to drain out of them as they cool, leaving a small dry-appearing crackling, one may be sure the lard has cooked long enough Pour the lard from the kettles, strain through a piece of cheesecloth, and press the cracklings in order to get all the fat squeezed out of them Small hand presses are available for this purpose Pour the fat into wooden tubs or carthen jars If the lard is stirred frequently while it is cooling, it will appear finer grained and lighter in color when it finally hardens Place covered tubs or jars in a cool, dry room, where the lard will keep several months without refrigeration

Making Headcheese. A type of prepared meat that is considered a delicacy in many homes on farms where hogs are slaughtered to provide pork for the table is commonly called "headcheese" As the name of the product suggests, it is made largely from meat trimmed from the head of the hog Meat from the legs, the tongue, and the heart is often added to that secured from the head In making headcheese, the first step is to cut and saw the head lengthwise into two pieces Remove the eyes, eardrums and brain, and remove the skin from the nostrils Then thoroughly wash the two pieces in cold water The jowls are usually removed and not used in headcheese

Place the two pieces of the head in a kettle, cover with water, and boil until thoroughly cooked, when the meat will separate readily from the bones The tongue and legs may be cooked with the head After the meat is thoroughly cooked, remove it from the kettle, separate the bones, and chop the meat into small pieces Mix thoroughly, adding the desired seasoning A typical seasoning mixture may be composed of 1 to 2 lb of salt, 3 oz of pepper, and 3 to 4 oz of cloves for each 50 lb of the head cheese mixture After thoroughly mixing, place the meat back in the "liquor," or juice, in the kettle in which it was boiled, and cook again for a brief period of 10 to 15 min Pour the entire mixture into jars or shallow pans, and place a weight on the meat while still warm Then allow it to cool and solidify, and the headcheese is ready for slicing and eating If stored in a cool room where the temperature remains fairly uniform, it will keep for several weeks

Making Scrapple "Scrapple" is the name commonly given to a modified form of headcheese made by adding corn meal or other cereal to the headcheese mixture Add the corn meal or cereal after the meat has been removed from the bones, chopped or put through a sausage grinder, seasoned, and placed back in the liquor in the boiling kettle

Enough corn meal is added to make a mixture resembling a thick mush. Allow the entire mixture to cook for another hour, when it is ready to be poured into shallow pans to cool. Stored in a cool room, scrapple will keep for several weeks. It is usually prepared for eating by slicing and frying the slices.

Curing, Smoking, and Storing Pork. Pork is cured and smoked to preserve it and to give it a more desirable flavor. The principal preservative used is common salt. Sugar is nearly always added to the curing mixture to improve the flavor, and saltpeter to improve the color. Smoking improves the flavor still further and serves as an additional preservative by closing up the open pores in the exposed surfaces of the pieces of meat. Large earthen jars or strong, watertight, wooden barrels (preferably of oak) are suitable receptacles in which to place meat being cured. There are two common methods of curing meat, the brine cure and the dry cure.

Brine Curing. A method often used in home or farm curing is the brine cure. A common formula for preparing the brine is to mix 12 lb. of salt, 3 lb. of sugar, and 2 oz. of saltpeter for each 100 lb. of meat to be cured. After the barrel or jar in which the meat is to be placed has been thoroughly washed and scalded with boiling water, rub each piece of meat thoroughly with the dry-curing mix, and begin packing the meat into the container by laying large pieces on the bottom, skin side down. Lay the top pieces skin side up. Place a weight of some kind, preferably heavy oak boards and hard-glazed bricks, on top of the meat to keep the pieces from floating when the brine is poured over it.

Next, boil 6 gal. of water for each 100 lb. of meat to be cured, and dissolve in it the remainder of the dry mix prepared and used in rubbing the meat. Allow this to cool, then pour it over the pieces of meat in the receptacle. The pieces must remain in the brine about 3 to 4 days for each pound they weigh. This means that the smaller pieces will be completely cured and ready to come out of the brine in less time than the larger ones. This is usually accomplished by repacking the meat when a number of the smaller pieces have been in long enough to equal 3 to 4 days for each pound. Hang the smaller pieces up to drain, and repack the larger ones in the brine. By this time, the brine may have started to sour or become ropy. If it has, it should be boiled, cooled, and poured over the meat again, or it may be discarded and a new brine made. If the brine remains in good condition when the meat is repacked, use it again just as it is.

Some small pieces of meat, such as the cheeks, the tongue, and other

small cuts including pieces of the back and loin cannot always be used fresh as chops or roasts; these should be removed from the brine in 7 to 10 days. There will be others such as the bacons that should be removed in 22 to 26 days, and some larger pieces like the hams and shoulders that need to be repacked and remain in the brine still longer. When all the meat has had the necessary time in the brine, wash each piece, including the smaller ones removed earlier, in clean, cold water, and hang up in the smokehouse to drain for a day before smoking is started. Hang each piece on a galvanized wire or piece of strong cord; binder twine is often used for this purpose.

Dry Curing. In dry curing pork, a mixture of salt, sugar, and saltpeter is rubbed on the meat, and it is packed away "dry" for the curing process. A common formula sufficient for 100 lb. of meat is 8 lb. of salt, 2 lb. of brown sugar, and 2 oz. of saltpeter. Mix these three ingredients together thoroughly, and rub each piece of meat carefully, using about half the mixture for the first rubbing of the pieces to be cured. Place the meat on a table for a day or two to drain. Then pack the cuts in a stone jar, hardwood barrel, or box. On the third day, rub in the remainder of the mixture, and repack. Repack again on the tenth day, placing the pieces at the top that were formerly on the bottom. Two to three days for each pound a piece of meat weighs is the proper curing time for the dry method Thus, an 8- to 10-lb. ham requires 20 to 30 days to cure. At the end of the required time, remove each piece, and hang up until smoked. Before smoking, wash each piece in clean, cold water.

Smoking. After meat has been cured either by the brine-cure method or by the dry-cure method and then washed, it is ready for smoking. Smoking adds to the flavor and helps to preserve the meat. Small quantities of pork may be successfully smoked in a barrel with the head taken out and a hole cut in the bottom to receive the smoke. Such an arrangement is shown in Fig. 256.

On a farm where it is the practice to slaughter two or more hogs each year, it will pay to provide a suitable smokehouse for smoking the meat. If made of concrete, tile blocks, or brick, such a smokehouse also makes a satisfactory room in which to let the pieces of meat hang until they are used. Such special smokehouses are to be found on many farms A highly satisfactory one is shown in Fig. 257. If the smokehouse is made with side walls 8 to 10 ft. high, the fire for smoking may be made in the center of the floor under the meat, though it is

safer and more satisfactory to have the fire pit outside the smokehouse and take the smoke into the house through a short tunnel.

What a piece of cured pork will be like when it goes into the smokehouse depends on the quality of the hog slaughtered, what the hog was fed, and the quality of workmanship in slaughtering, dressing, cutting, and curing the meat. What it will be like when it comes out of the smokehouse depends on the wood used, the care and patience exercised in building and watching the fires, and the lightness or strength of smoke flavor.

The flavor secured by using green hickory wood for smoking is universally preferred. In localities where *hickory* is not available except at high cost, *apple* and *maple* are second choices, and probably *corncobs*

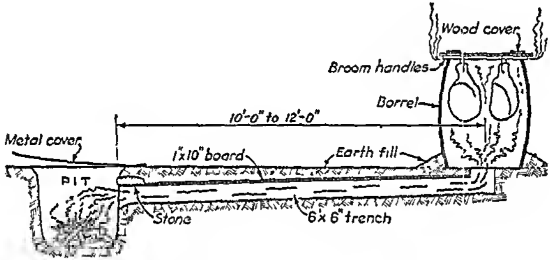


FIG 256. *A small outfit made inexpensively for home smoking of pork.* (*U.S. Department of Agriculture.*)

third. *Pine woods impart an undesirable flavar and should never be used.* Smoking is usually accomplished by starting a fire in the smokehouse in the morning, then allowing it to burn itself out. Another is started the next morning. This is continued for 7 to 10 days. By this time all pieces of meat will be sufficiently smoked for preservation and will possess about the flavor preferred by most people. If some of the pieces of meat are small and some large, it may be desirable to remove the small ones after 3 or 4 days to avoid giving them too strong a smoke flavor. Smoking can be speeded up by maintaining a continuous fire. About 48 hr. of continuous smoking is required to produce a moderate smoke flavor and serve the smoke-preservative purpose. Following smoking, place pieces of meat that are to remain in the smokehouse for storage or to be stored elsewhere without refrigera-

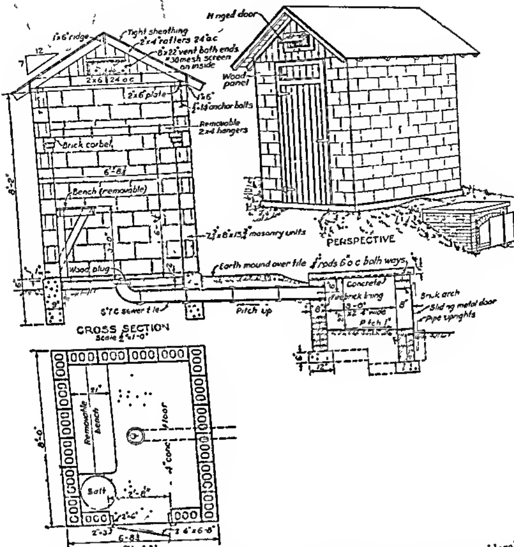


Fig. 257. A permanent type of smokehouse suitable on a farm where considerable pork is smoked for home consumption each year. (*U.S. Department of Agriculture.*)

tion in paper sacks, or carefully wrap and tie in wrapping paper to prevent any possible contact by insects.

3. Preparing Dairy Products for Home Use

On farms not specializing in any form of dairying, the maintenance of one or more cows to provide milk and cream for the table offers one of the most important sources of food for home use that can be economically provided. The need for fresh, sweet milk and cream for their health-giving qualities, especially for growing children, and the

pleasure they add to the diet are the most important reasons for maintaining enough cows on the farm to provide their products. Sweet milk and cream are highly perishable products even when kept under refrigeration, and a fresh supply must be secured at least every other day. The difficulty and cost of securing these items in any way other than maintaining one or more cows would eliminate their regular use on many farms.

In early times it was the general practice to churn butter on the farm for home use and in case of a small surplus to sell it to the village grocer. Now the common practice is to put any surplus cream there may be in a can and take it to a nearby creamery once or twice per week, then buy the butter needed from the creamery or store. This practice is popular with farm families because it eliminates the work of churning butter and, especially, because modern creamery methods of making butter result in a more uniform product of much higher quality than is usually secured by farm churning. On farms where a large number of persons must be provided with food, it may still be economical and desirable to churn butter.

Cheesemaking, like buttermaking, has developed into a factory specialization, and many farm families find it more economical and desirable to buy cheese as needed, rather than to attempt making it. One exception to this is the making of *cottage cheese.* This is a very simple procedure and can be accomplished in the home about as easily and successfully as in a creamery. In making cottage cheese, sometimes called "Dutch cheese," skim milk is allowed to sour until it is thoroughly curdled. The whey is then drained off by pouring the soured milk into a colander or cheesecloth and allowing it to drain thoroughly. A little salt and some sweet cream are then added, to give flavor, richness, and improved texture to the cheese. Cottage, or Dutch, cheese is a favorite dish on many tables.

4. Preparing Beef for Home Use

There are several reasons why the slaughter of a beef animal on a farm to provide meat for the home table has less to recommend it than the slaughter of hogs. The beef animal is larger and more difficult to handle than a hog. The hide must be removed from the beef carcass, which is a much more difficult task to the inexperienced operator than are the scalding and scraping of a hog. In the commercial slaughter and processing of cattle, many by-products are secured that repre-

sent an appreciable part of the total return from the animal Under farm slaughter a low grade hide is about all that can be salvaged as a by product The financial advantage or saving of money by farm slaughter is therefore not so large for cattle as for hogs

The most important problem of all in the farm slaughter of beef is that the meat cannot be cured easily for preservation and must be stored under refrigeration, canned, or used fresh This makes it difficult for any farms except very large ones where many men are employed to use a beef carcass satisfactorily unless refrigeration is available for cooling and storage of the meat

Where the farm family includes only two or three persons, the economical and most satisfactory plan of securing beef for the table will probably be to purchase it as needed at the retail meat shop In normal times where the family consists of five to eight persons and a large quick freezing unit is available in the home or a locker can be rented in a nearby locker plant, the economical plan for providing beef will probably be to buy a quarter or several wholesale cuts at a time or cooperate with several neighbors in the slaughter and dividing of a beef animal There will also be many instances where it will be desirable to slaughter and process an entire beef animal for use on a single farm or ranch An attempt will be made to present just enough of the fundamental procedures in slaughtering and cutting a beef carcass so that the interested reader will be able to accomplish the task in a fairly successful manner until such time as he may gain additional knowledge by experience

Slaughtering and Dressing a Beef At least one of the objects in slaughtering a beef animal to produce meat for home use is to have beef of good quality This is most certain to be secured if a young steer or heifer, preferably eighteen to thirty months old, that has been fed grain long enough to make it moderately fat is slaughtered It is more wasteful to slaughter an inferior or thin animal for home use than to slaughter a good one for a higher proportion of the value of an inferior animal is represented in by product materials which can not be salvaged under farm slaughter The animal to be slaughtered should receive no feed for 18 to 24 hr preceding slaughter This will reduce the content of the digestive system and thus simplify removal of the offal or internal organs Perhaps more important it will cause more complete drainage of blood and produce a superior carcass of beef

Stunning The animal to be slaughtered should be taken to the place

of slaughter and fastened to a strong post or solid object by using a strong halter or rope around the neck so that it cannot get away in case the first attempt to stun should not prove successful. If the animal is very wild, it should be shot through the head in the yard without trying to catch and secure it. An animal that is allowed to become excited or heated just before slaughter will not bleed thoroughly and a discolored carcass that will not keep well may result. If the animal must be stunned in a yard, bleed it immediately, then take to the place where it is to be skinned by rolling it onto a stoneboat and drawing it with a team of horses. If the animal is quiet so that it can be led with a halter and fastened, it is preferable to stun by striking in the center of the forehead midway between the eyes and the horns with a long-handled heavy hammer.

Bleeding. Immediately after it has fallen after being shot or struck for stunning, the throat of the animal should be cut to allow the blood to escape. The amateur at this work will succeed best by making a long incision through the skin, beginning just in front of the brisket and extending almost to the jaw. Insert the knife deep enough to cut the large arteries and veins in the neck. The experienced hand prefers to open the blood vessels by splitting them. The beginner will do well to cut crosswise to be sure to sever them promptly.

Skinning. Skinning a beef is a slow, tedious job for the beginner and requires considerable patience. It is preferable that two or more persons be available for this task. As soon as bleeding is complete, the skinning may begin. In skinning, start with the head. Open the skin by cutting from the base of one horn down to the nostril on the same side of the head. The next step is to cut from this same nostril under the jaw to meet the opening made along the throat for bleeding. This more or less triangular piece of skin is then loosened back to a line around the neck just behind the horn. The flap of skin is removed over the face, the head turned over, and the other cheek skinned back to the line around the neck just behind the horns, or poll. Next, remove the head by bending it back on the poll, or horns, with the left hand and cutting it off just behind the jawbones and horns. It may be necessary to twist the head to get it to separate from the backbone at the atlas joint.

It is then necessary to get the animal propped on its back with the four legs up. Hold it in the position by placing a large block of wood against the shoulder on either side or by cutting two sharp pointed sticks about the length of a broom handle and propping the animal

up with them Continue skinning by opening the hide on the back of the shanks At this point, two, three, or four persons can work at the skinning, each taking a leg Open the skin on a straight line down ward to the heels and upward to the center line running the length of the belly On the hind legs these lines should meet at about the point where the legs separate, commonly called the "twist" As the legs are skinned out, cut off the shanks at the smooth joint below the knee and hock If cut at the correct joint, they can be separated by using the knife only The beginner may need to experiment with the knife a little before striking the correct place to cut off the shanks, but he will have mastered this trick by the time he gets to the third or fourth animal

The hide is then opened from front to rear by continuing the open ing made for bleeding down the center of the belly to the root of the tail The hide can then be peeled back along both sides at least half way down each side At this point, it is necessary to start raising the rear end by fastening the beef tree singletree, or wagon neckyoke, in case such makeshift equipment is used to serve as a beef tree, to the hocks A block and tackle hoist, preferably a chain one, is used to raise the carcass As the carcass is raised a foot or so at a time, con tinue skinning The aitchbone is cut or in older animals sawed through, the body cavity opened and the end gut loosened by cutting around it and dropping it down into the abdominal cavity This will require some cutting, *be careful not to cut the gut itself* The tail is skinned out by splitting the hide down the underside of it, then cutting the tail off close to the body and pulling it out of the skin rather than trying to remove the skin

As the carcass reaches a height about on the level of the shoulders, begin splitting by sawing down the center of the backbone with a large meat saw As soon as the carcass is raised high enough so that the neck swings clear of the floor, finish skinning The opening of the carcass is then completed by cutting through the body wall down the center line of the belly to and through the breastbone The saw or cleaver will need to be used in cutting through the breastbone The digestive tract may then be dropped out into a wheelbarrow or cart that has been provided to receive it Remove the liver by loosening it so far as possible with the hands and cutting the attachments that do not pull loose readily The liver should be placed in a clean receptacle and the gall bladder removed at once The diaphragm must then be cut Instead of cutting close to the ribs as in dressing a hog, the dia

phragm of the beef animal should be cut at the line where the muscle tissue ends and the membranous tissue begins. This muscular part of the diaphragm is edible and should be saved. Remove the heart, lungs, and gullet by pulling with the hands and cutting where necessary. The heart is separated and used, the lungs discarded. Complete splitting down the backbone with the saw, and the carcass is ready to be washed outside and inside with clean cold water.

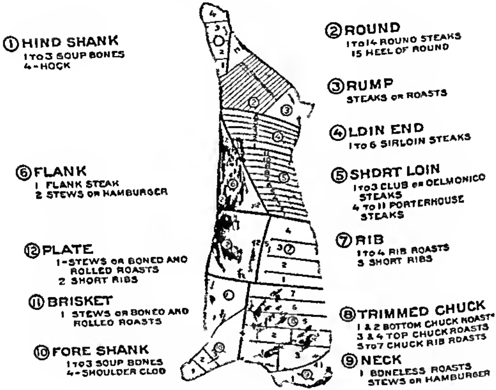
Cooling. If the beef carcass is cooled without refrigeration, it must hang in the open air at least 12 hr. Open-air slaughter, cooling, and storage of the meat can be accomplished successfully in climates where the temperature remains down around freezing or below for some weeks at a time. In warm weather or warm climates, the slaughter of a beef animal should not be attempted unless refrigeration that can be kept between 33 and 40°F. is available. Beef that must be eaten within 3 or 4 days following slaughter is not relished by most people. If handled without refrigeration in warm weather, it must be consumed within this period to avoid spoilage. Thus it is evident that successful home slaughter of cattle requires that suitable refrigeration be available. On a large farm or ranch, satisfactory refrigeration may be provided by the liberal use of ice in a well-constructed, well-insulated, small storage room. Successful cooling and storage are most satisfactorily secured when an electrically cooled large-sized home freezer unit is available or when a locker may be rented in a community cold-storage building.

Cutting the Beef Carcass. The tongue, liver, and heart are edible parts removed from the beef carcass at the time of slaughter. They are usually prepared and consumed while fresh. The side of beef should be allowed to cool for 24 hr. before it is cut into pieces. A long-bladed, sharp knife and a sharp meat saw are the only tools needed for the work of cutting the carcass.

The first step in cutting up the side is to separate the front quarter from the hindquarter by cutting across the side just behind the thirteenth rib. The quarters are then cut into the large pieces or wholesale cuts as shown on the chart in Fig. 258. The beginner will have little trouble following the lines along which to make the wholesale cuts. If beef is to be stored for some time in temperatures above freezing, it is preferable that it be left in the wholesale cuts and the smaller pieces cut off as needed. If it is to be stored in a quick-freezing locker, the carcass should be cut up into the small roasts and steaks before it is frozen. The beginner will find the work of cutting the

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

BEEF CHART
WHOLESALE AND RETAIL CUTS



Numerals in circles ○ refer to wholesale cuts and major subdivisions of such cuts. Other numerals refer to retail cuts

WHOLESALE CUTS AND SUBDIVISIONS
ALL PERCENTAGES BASED ON CARCASS WEIGHT

① TO ⑥ HINDQUARTER		48.0%	⑦ TO ⑫ FOREQUARTER		52.0%
① TO ③ ROUND AND RUMP		24.0	⑦ RIB		9.5
① HIND SHANK	4.0%		⑧ & ⑨ CHUCK		22.0
② BUTTOCK	15.0		⑧ TRIMMED CHUCK	17.0	
③ RUMP	5.0		⑨ NECK	5.0	
④ & ⑤ FULL LOIN INC. SUET		20.5	⑩ FORE SHANK		5.5
④ LOIN END	7.0		⑪ BRISKET		6.5
⑤ SHORT LOIN	10.5		⑫ PLATE		8.5
KIDNEY KNOB	3.0				
⑥ FLANK		3.5			

FIG 258 A diagram helpful in cutting up a side of beef (*U S Department of Agriculture*)

large pieces into the small ones a slow, tedious job. Proceed cautiously and carefully, figuring out just how each cut with the knife is to be made before beginning to make it. Proficiency in this work can be gained only by experience. If the beef is cut into small pieces for storage, wrap each piece in heavy waxed paper, made especially for the purpose, before placing in the freezer.

Beef will have lost its animal flavor and be suitable for eating after 3 to 4 days cooling. From that point on, it improves in flavor and in tenderness up to 2 weeks in storage for meat that is high in percentage of lean muscle tissue and low in fat and up to 6 weeks in storage for thick cuts that are high in fat content. Lean meat with little fat shrinks more rapidly and begins to deteriorate in flavor in storage more quickly than does meat with considerable fat. Beef kept in storage above the freezing point should be used within about 6 weeks following slaughter. Stored by quick freezing in below-freezing lockers it may be kept much longer with little shrinkage or deterioration.

5. Preparing Veal for Home Use

Veal is seldom slaughtered on farms for home use. This is because most families relish veal only as an occasional variation in the meat diet and tire of it quickly when served regularly. As a result, it is usually more economical for the farm family to purchase an occasional veal roast or veal chops from the retail meat shop than to slaughter and use an entire veal carcass on the farm. As in slaughtering a beef animal, the commercial meat processing plant can salvage considerable by-product material from the calf that cannot be salvaged in farm slaughter. There are occasions, however, when the farm slaughter of a calf is desirable. This is especially applicable to homes where the number of persons to be served regularly is about eight or more.

To produce a desirable veal carcass the calf to be slaughtered should be six to eight weeks old and in good thrift, and it should have received milk as its only food. Calves that have received feeds other than milk are properly termed "calf carcasses" and produce meat lacking the characteristic flavor of milk-fed veal. Withhold feed 18 to 24 hr. before slaughter.

Slaughtering and Dressing a Veal. Stunning, bleeding, skinning, and removing internal organs may proceed just as in slaughtering a beef. Since the live calf will weigh only 150 to 250 lb., it may best be

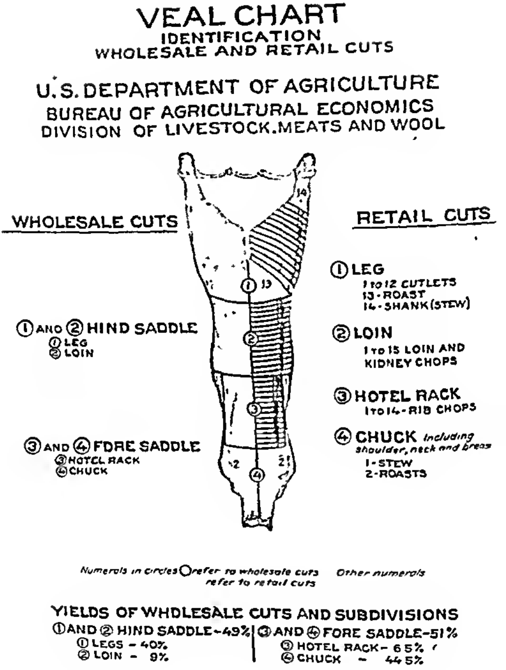


FIG. 259 A diagram helpful in cutting up the carcass of veal. (*U.S. Department of Agriculture.*)

handled by laying it on a table similar to the one recommended for scraping a hog. Place the calf on this table with its head over the edge before bleeding. This will prevent the hide from becoming smeared with blood.

In farm slaughter, since the meat will be used in a short time, it is preferable to remove the hide at time of slaughter and handle the carcass as carefully as possible to prevent shrinkage, bruising, and soiling. If care is used in skinning and in removing the internal organs, the veal carcass need not be washed. Rub soiled spots clean with a dry, clean piece of cheesecloth. The veal carcass must be cooled and stored under refrigeration if the meat is to be satisfactory.

Cutting the Veal Carcass. Since the veal carcass is light enough in weight to be easily handled, the beginner should have little trouble cutting it into the small pieces for preparation for the table as indicated in the chart in Fig. 259. As in cutting the beef carcass, proceed cautiously, and figure out just how the cutting will result before starting the cut.

6. Preparing Lamb for Home Use

Lamb and mutton, though especially well suited to farm slaughter, are not generally provided through home slaughter. There are two reasons why this is true. (1) Sheep are not so generally raised on all farms. (2) Many persons do not relish or at least believe they would not relish the taste of lamb or mutton. The average annual per capita consumption of lamb and mutton in the United States is only 6 to 7 lb. Many families do not eat any lamb or mutton; others serve it only once or twice a year.

On the other hand, lamb is a wholesome, healthful, easily digested meat, and the slaughter, dressing, cutting, and use of a lamb constitute a simple procedure. It is true that some by-product materials that contribute materially to the proceeds from sheep and lambs in commercial slaughter and processing cannot be salvaged in farm slaughter. Even under this handicap, providing lamb for home consumption by farm slaughter is often an economical method of securing meat.

Slaughtering and Dressing a Lamb. The lamb rather than the sheep is recommended for home slaughter because the meat is of more desirable flavor and the sheep can be handled so much more efficiently in the processing plant. That is, there is less wastage of by-products

in the farm slaughter of a lamb than there would be in the slaughter of a mature sheep.

Bleeding and pelting a lamb or mutton carcass differ considerably from the procedure in slaughtering and dressing a veal. For bleeding, lay the animal on its side on a table with the head hanging over the edge to prevent the fleece from becoming smeared with blood. The veins and arteries of the neck are severed by cutting straight across just behind the lower jaw.

The pelt is most easily removed by starting with a sharp knife at one front foot and splitting the skin down to the jaw. Then split down the skin on the other front foot until you meet the first cut made about at the point of the brisket.

Open the skin on the hind legs to the root of the tail. Skinning of the hind legs is then completed and the hind feet cut off at the first pastern joint above the foot. Pull the triangular strip extending between the forelegs backward to the foreflanks. The skin is then loosened on the underside of the lamb by forcing the closed fist under it and backward over the belly. This leaves the thin membrane separating the skin from the flesh attached to the flesh, where, in the dressed lamb, it serves as a protective covering of the carcass. At this point, the tendons of the hind legs are exposed and tied together so that the carcass can be hung over a hook. This hook should be securely fastened about 6 ft. off the ground or floor level. Split the skin down the center of the belly, and "fist" loose around both sides up the rear legs and down the back, then down over the shoulder, neck, and forelegs. The head is usually cut off, the pelt with the head on it placed on a table, and the head skinned out. The beginner at skinning a lamb should work slowly and cautiously to avoid having the thin membrane covering the flesh begin to come off with the pelt. If it does, the flesh will tear easily and a rough job will result. If this membrane does begin to adhere to the pelt, release it carefully with a sharp knife and make a fresh start with the fist. The offal, liver, heart, and lungs are removed in a manner similar to the procedure followed with a hog, beef, or veal.

Cutting the Lamb Carcass. The lamb carcass is not split down the backbone until it is cut into large pieces. The most satisfactory shaped pieces of meat for the table will be secured if the carcass is cut according to the directions on the chart in Fig. 260. Lamb and mutton improve in tenderness and flavor with aging in cold storage. Left as an

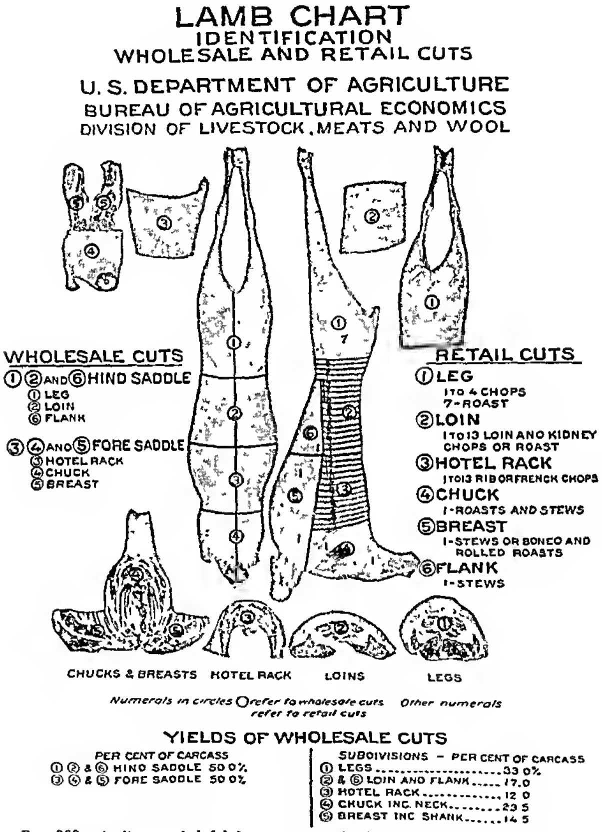


FIG. 260 A diagram helpful in cutting the lamb carcass (*U.S. Department of Agriculture.*)

entire carcass or in the large cuts, lamb or mutton will improve in flavor and tenderness up to 6 weeks in storage If stored for a longer period in above freezing refrigeration, the shrink due to drying out and the necessary trimming may become excessive

7 Providing Cold Storage for Meat

To keep meats in fresh form for any length of time, it is necessary to freeze them at sub zero temperatures and store them at about zero temperature Low temperature retards the development of bacteria and other organisms and checks chemical action in the meat

Two methods of quantity storage are in use, the central, or community, freezer locker plant patronized by a large number of families and the home freezer units installed in individual homes

Using the Freezer Locker Plant As mentioned in the first part of the chapter, the development of freezer locker plants is fairly new Such plants have been built in many communities in the last 20 to 25 years Each locker plant is a place where freezer storage is provided for a large number of individual families to store meats, butter, eggs vegetables fruits and other foods These products when brought to the plant are quick frozen and stored in lockers or drawers, each rented by a family for its use The average locker plant has nearly 300 of these compartments Rents for such locker space are nominal, ranging from as low as $20 per year to about $30 Many locker plants are owned and operated by private firms although some are cooperatively organized

Many of the locker operators provide such services as cutting carcasses of animals into suitable pieces for storage and use, curing and smoking pork rendering lard and making sausage Some operators provide slaughter service too They provide wrapping paper for wrapping the pieces of meat separately and other items needed in placing foods in the storage lockers Some also provide service kitchens to which fruits and vegetables may be brought for cleaning and preparation for storage The storage lockers are used by many families in towns and cities as well as by farm families

Installing Freezer Units for Home Use A popular development for *quick freezing* meats and other food products and holding them at a temperature of around zero is the family sized freezer unit installed in the home It seems probable that such units will be increasingly available and that many families will purchase them since they eliminate

travel to the community locker plant. The source of power for these units is electricity; hence, the electrification of rural homes is an important part of this development. Separate home freezer units now available have a capacity ranging from 9 to 20 cu. ft.

Using Facilities for Freezing Meat. It is not likely that farm families will wish to store all their meat in frozen form. Probably, they will wish to cure and smoke some of it, as described on previous pages. Canning in tin cans in community canneries or in the home is another desirable method of storing part of the family meat supply where can

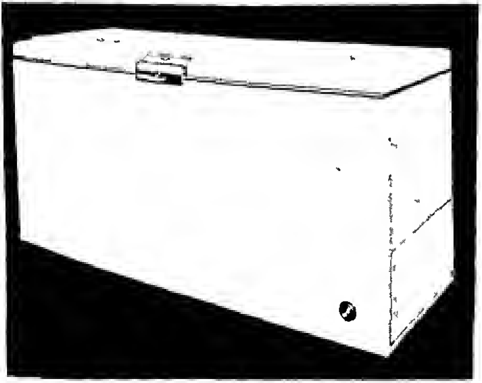


FIG 261. A modern home freezer of 12 cu ft capacity. (*Courtesy Frigidaire Division, General Motors Corporation.*)

sealers and pressure cookers are available. In using this method or any other method, directions from the college of agriculture or other reliable sources should be followed.

In preparing the meat for freezing after slaughtering, allow the carcass to cool thoroughly in temperatures of 32 to 34°F. If the weather is too warm, hang the meat in the chillroom of the locker plant. Lamb, pork, and veal need be left for only 1 or 2 days, while beef is frequently left several days to "ripen," or age, which improves the flavor.

After cooling, cut the carcass into the commercial cuts, as described on the preceding pages. Next, cut the meat into pieces suitable for

using at one meal or for cooking at one time. Less desirable pieces can be boned and ground before freezing.

Wrap the cuts of meat in paper, specially made for this purpose, that is waxed on one side only. Place the waxed surface next to the meat so that the package can be labeled easily. Use care in wrapping to make the package as airtight as possible, and then fasten it with gummed tape or wrapping cord. Each package label should show the following data: kind of meat, particular cut; weight, date frozen Freeze immediately after wrapping to prevent the meat juices from soaking the wrapper. Ten degrees below zero is generally accepted as the best temperature for "sharp" freezing of meats Temperatures of around zero are most satisfactory for storage after the meat is frozen

SUPPLEMENTARY ACTIVITIES

1 Secure information on the extent to which food products from animals are produced and provided for home use on your home farm Compare with data in Table 52 as to kinds and amounts of each product used Discuss methods used in preparing and preserving these products What are the advantages gained by home production? What animal products for your home farm might be added or increased?

2 Report to your class on the procedure followed in butchering, cutting, and preserving pork (or some other meat) on your home farm What suggestions have you for improving the procedure now in use?

3 With others in your class, plan with your teacher to slaughter one or more hogs (or other kind of livestock) according to approved methods Following this, secure further experience by working with your father and others in slaughtering animals on your home farm

4 With others in your class, plan with your teacher to cut up a pork, beef, or lamb carcass Secure further experience by assisting at home

5 Visit a freezer locker plant in your community, and observe the procedures used in preparing the cuts of meat for storage and storing the meat in the individual lockers

6 Assist your parents in curing and smoking pork for home use

Appendix I

Tables

TABLE 53 FORM FOR A COST OF PRODUCTION ANALYSIS OF SOW AND LITTER PROJECTS*

Part I Production and Income

Number of sows____Beginning________, 19__ Farrowing date________, 19__
Weaning date________, 19__Marketing or inventory date________, 19__
Number of days farrowing to weaning______weaning to marketing______Total____.
Number of pigs farrowed____Number raised to weaning____Weight____lb Value $____
Number raised to market weight ____Weight____lb Value $____

Breeding to marketing (B-M) period			
Closing inventory of animals produced	$____		
Inventory of sows at weaning time	$____		
Receipts from sales and use of animals	$____		
	Total (A)	$____	
Beginning inventory of sows	(B)	$____	
Net increase for enterprise, breeding to marketing period (subtract B from A)			$____
Weaning to marketing (W-M) period			
Closing inventory of animals produced	$____		
Receipts from sales and use of animals produced	$____		
	Total (C)	$____	
Value of pigs at weaning time	(D)	$____	
Net increase for weaning to marketing period (subtract D from C)			$____
Labor income †			$____

Part II Cost of Production, Feed Summary, and Labor Summary

	B W	W M	B-M
Feed (Grain $____) (Supplements $____) (Pasture $____)	$____	$____	$____
Paid labor and power	____	____	____
Charge for____hours of unpaid man (including student) labor at____¢	____	____	____
Overhead and miscellaneous costs	____	____	____
Decrease in inventory of sows	____	XXXX	____
Decrease in inventory of buildings and equipment	____	____	____
Totals (E)	$____	$____	$____
Increase in inventory of sows	$____	XXXX	$____
Sale of sows	____	XXXX	____
Miscellaneous credits	____	____	____
Totals (F)	$____	$____	$____
Total cost of producing animals (subtract F from E)	$____	$____	$____

Hours of man labor Self____Other unpaid____Total unpaid____Paid____Total____
Hours of unpaid man (including student) labor by periods B W____W-M____B M____

* From "Record Book" for students of vocational agriculture in Ohio by Kenestrick and Bolender, published by The Enterprise Cooperative Company, New Concord, Ohio.

† The item on labor income is obtained from the financial summary in the "Record Book."

TABLE 53. FORM FOR A COST-OF-PRODUCTION ANALYSIS OF SOW-AND-LITTER PROJECTS.*—(Continued)

Amount of feed used by periods	B-W	W-M	B-M
Grain	____lb.	____lb.	____lb.
Tankage or trinity mixture	____lb.	____lb.	____lb.
Skim milk (tankage equivalent)	____lb.	____lb.	____lb.
____	____lb.	____lb.	____lb.
____	____lb.	____lb.	____lb.
Total	____lb.	____lb.	____lb.
____ ____ pasture	____days	____days	

Part III. Efficiency Factors

1. Breeding to marketing

Pounds of pork produced per sow .... ____lb.
Labor income per sow .... $____
Labor income per hour .... $____
Returns per hour for all man (including student) labor .... $____
Returns per $1 worth of feed .... $____
Pounds of feed fed for each pound of pork produced .... ____lb.
Feed cost per 100 lb. of pork .... $____
Total cost per 100 lb. of pork .... $____
Average selling or inventory price per 100 lb. of pork .... $____
Hours of man (including student) labor per 100 lb. of pork produced .... ____hr.

2. Breeding to weaning

Number of pigs farrowed per sow .... ____
Number of pigs raised per sow .... ____
Feed cost per litter .... $____
Total cost per litter .... $____
Feed cost per pig .... $____
Total cost per pig .... $____

3. Weaning to marketing

Average daily gain per pig .... ____lb.
Pounds of feed fed for each pound of gain in period .... ____lb.
Returns per $1 worth of feed used in period .... $____
Feed cost per 100 lb. of pork produced in period .... $____
Total cost per 100 lb. of pork produced in period .... $____

Part IV. Practices Used

Breed of sows____Purebred or grade?____Breed of boar____Purebred or grade?____
Was flushing practiced?____What protein supplements were fed during the breeding to weaning period?____
What sanitation program was carried out?____
____
Were sows vaccinated against cholera?____Were pigs vaccinated?____Was a creep used?____
What protein supplements were used during the weaning to marketing period?____
What kind of pasture was used for sows?____For pigs?____
If self-feeder was used, during what period?____
Was feed mixture used in feeder, or was free choice allowed?____
How were hogs marketed?____

TABLE 54 FORM FOR COST-OF-PRODUCTION ANALYSIS FOR FEEDER CATTLE, PIGS, OR LAMBS*

Part I Production and Income

Beginning of period________, 19__Number of animals____Weight____lb Value $____
End of period__________, 19__Number of animals____Weight____lb Value $____
Number of days in period______________Pounds of gain produced__________

Closing inventory of animals	$____		
Receipts from sales or use of animals	$____		
	Total (*A*)	$____	
Beginning inventory of animals	$____		
Additional investments in animals	$____		
	Total (*B*)	$____	
Net increase for enterprise (substract *B* from *A*)			$____
Labor income†			$____

Part II Cost of Production, Feed Summary, and Labor Summary

Feed (Grain $____) (Supplements $____) (Hay $____) (Silage $____) (Pasture____)	$____	
Paid labor and power	$____	
Charge for____hours unpaid man (including student) labor at____¢	$____	
Overhead and miscellaneous costs	$____	
Decrease in inventory of buildings and equipment	$____	
	Total (*C*)	$____
Miscellaneous credits	(*D*)	$____
Total cost of producing gain (subtract *D* from *C*)		$____

Hours of man labor Self____Other unpaid____Total unpaid____Paid____Total______
Pounds of grain____Pounds of supplements____Total pounds of concentrates______
Tons of hay____Tons of silage______Animal months of pasture__________

Part III Efficiency Factors

Pounds of gain per day per animal	____lb
Labor income per animal	$____
Labor income per hour	$____
Returns per hour for all man (including student) labor	$____
Returns per $1 worth of feed	$____
Feed cost per 100 lb of gain	$____
Total cost per 100 lb of gain	$____
Average selling or inventory price per 100 lb	$____
Gain or loss in price per 100 lb during period	$____
Hours of man (including student) labor per 100 lb of gain produced	____hr

* From "Record Book" for students of vocational agriculture in Ohio by Kenestrick and Bolender published by The Enterprise Cooperative Company New Concord Ohio

† The item on labor income is obtained from the financial summary in the "Record Book."

Table 55 The Percentage Composition of Feedstuffs Used in Animal Feeding*

Grains, Seeds and Mill Concentrates

Feedstuff	Moisture	Ash	Crude protein	Ether extract†	Crude fiber	Nitrogen-free extract†	Calcium‡	Phosphorus‡
Barley	9.6	2.9	12.8	2.3	5.5	66.9	0.07	0.32
Barley feed	7.9	4.9	15.0	4.0	13.7	54.5	0.03	0.41
Bread, kiln-dried	10.5	2.1	12.5	1.6	0.4	72.9	0.03	0.12
Brewers' dried grains								
18–23 per cent protein	7.9	4.1	20.7	7.2	17.6	42.5	0.16	0.47
23–28 per cent protein	7.7	4.1	25.4	6.3	16.0	40.3	0.16	0.47
Brewers' rice	11.6	0.7	7.0	0.8	0.6	79.3	0.03	0.25
Buckwheat	12.6	2.0	10.0	2.2	8.7	64.5		
Buckwheat middlings	12.4	4.6	28.0	6.6	5.3	43.1		
Cocoa shells	9.2	8.2	16.4	5.4	15.8	45.0		
Coconut cake	10.7	4.0	19.1	11.0	14.1	41.1		
Coconut meal, old process	7.3	5.5	21.3	10.0	9.4	46.5	0.28	0.58
Coconut meal, new process	8.9	6.6	21.4	2.4	13.3	47.4	0.28	0.59
Corn, shelled	12.9	1.3	9.3	4.3	1.9	70.3	0.01	0.26
Corn bran	10.0	2.1	10.0	6.6	8.8	62.5	0.03	0.14
Corn chop	11.3	1.4	9.8	4.1	2.1	71.3	0.01	0.26
Corn (ear) chop	10.7	2.0	8.2	3.4	9.2	66.5		
Corn feed meal	10.8	1.9	10.5	5.3	2.9	68.6	0.04	0.38
Corn-germ meal	7.0	3.8	20.8	9.6	7.3	51.5	0.05	0.59
Corn-gluten feed	9.5	6.0	27.6	3.0	7.5	46.4	0.11	0.78
Corn gluten meal	8.0	2.2	43.0	2.7	3.7	40.4	0.10	0.47
Corn-oil meal	8.7	2.2	22.1	6.8	10.8	49.4	0.06	0.62
Cottonseed, whole pressed	6.5	4.3	29.6	5.8	25.1	28.7		
Cottonseed cake	7.5	5.9	44.1	6.4	10.3	25.8		
Cottonseed feed, 32 per cent protein	8.3	4.8	32.1	6.4	15.3	33.1	0.20	0.73
Cottonseed hulls	8.7	2.6	3.5	1.0	46.2	38.0		
Cottonseed meal								
33–38 per cent protein	7.4	5.2	36.6	5.6	15.3	29.9	0.28	1.30
38–43 per cent protein	7.3	6.1	41.0	6.5	11.9	27.2	0.19	1.11
over 43 per cent protein	7.2	5.8	43.7	6.5	11.1	25.7	0.18	1.15
Distillers' (corn) dried grain	7.0	2.4	28.3	9.4	14.6	38.3	0.04	0.29
Distillers' (rye) dried grain	6.1	2.4	17.9	6.3	15.9	51.4	0.13	0.43
Feterita	9.1	1.7	14.2	2.9	1.4	70.7		
Hemp cake	10.8	18.0	30.8	10.2	22.6	7.6		
Hempseed, European	8.8	18.8	21.5	30.4	15.9	4.6		
Hominy feed	9.5	2.9	11.2	8.3	6.3	61.8	0.03	0.44
Kafir	11.9	1.7	11.1	3.0	2.3	70.0	0.01	0.25
Kafir head chops	10.4	3.9	10.9	2.5	6.0	66.3	0.09	0.20
Linseed meal								
33–38 per cent protein	8.5	5.6	35.3	5.4	8.3	36.9	0.36	0.84
38–43 per cent protein	8.5	5.3	40.4	5.8	7.5	32.5	0.33	0.74

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(*Continued*)

Grains, Seeds, and Mill Concentrates —(*Continued*)

Feedstuff	Moisture	Ash	Crude protein	Ether extract †	Crude fiber	Nitrogen-free extract ‡	Calcium §	Phosphorus §
Malt	7.7	2.9	12.4	2.1	6.0	68.9		
Malt sprouts	7.3	6.1	28.1	1.8	13.3	43.4	0.26	0.68
Mesquite beans and pods	6.6	4.5	13.0	2.7	22.8	50.4		
Millet, foxtail	10.1	3.3	12.6	4.3	8.4	61.3		
Millet, proso or hog millet	9.8	3.4	12.0	3.4	7.9	63.5		
Milo	9.3	1.6	12.5	3.2	1.5	71.9		
Milo head chops	10.4	4.3	10.7	2.6	7.1	64.9		
Molasses, cane	24.0	6.8	3.1			66.1	0.35	0.06
Oats, grain	7.7	3.5	12.5	4.4	11.2	60.7	0.10	0.40
Oat chops	8.9	3.9	12.8	5.0	11.8	57.6	0.10	0.36
Oat clips	9.0	9.3	11.8	4.5	22.7	42.7		
Oat groats, ground rolled	10.4	2.6	17.3	6.6	1.8	61.3	0.08	0.43
Oat hulls	5.8	6.5	4.3	1.9	30.8	50.7	0.09	0.12
Oatmeal	8.9	2.3	16.5	4.8	3.6	63.9	0.08	0.43
Oat millfeed	6.9	6.0	6.3	2.2	27.9	50.7	0.20	0.22
Palm kernel	8.4	1.8	8.4	48.8	5.8	26.8		
Palm kernel cake	10.1	3.9	16.2	11.0	21.4	37.4		
Peanuts, kernels	5.5	2.3	30.2	47.6	2.8	11.6	0.06	0.38
Peanuts shells on	6.0	2.8	24.7	33.1	18.0	15.4		
Peanut meal								
38–43 per cent protein	6.4	4.4	41.6	7.2	16.0	24.4	0.10	0.50
43–48 per cent protein	6.7	4.6	45.1	7.2	14.2	22.2	0.17	0.55
over 48 per cent protein	7.0	5.0	51.4	4.8	9.2	22.6		
Rapeseed brown Indian	5.7	6.4	21.0	41.2	12.5	13.2		
Rapeseed common	7.3	4.2	19.5	45.0	6.0	18.0		
Rice, rough	9.7	5.4	7.3	2.0	8.6	67.0	0.10	0.10
Rice bran	8.8	12.2	12.8	13.8	12.2	40.2	0.10	1.84
Rice hulls	6.5	21.9	2.1	0.4	44.8	24.3	0.08	0.06
Rice polish	10.0	7.6	12.4	13.2	2.8	54.0	0.03	1.52
Rice stone bran	8.4	11.9	12.5	13.0	11.1	43.1		
Rye	9.5	1.9	11.1	1.7	2.1	73.7	0.04	0.37
Rye feed	10.2	4.0	15.6	3.2	4.3	62.7		0.59
Rye middlings	9.5	4.4	16.7	3.7	5.5	60.2		
Sesame seed	5.5	6.5	20.3	45.6	7.1	15.0		
Sesame-seed cake	9.8	10.7	37.5	14.0	6.3	21.7		
Sorgo	12.8	2.1	9.1	3.6	2.6	69.8		
Soybeans	8.0	4.8	38.9	18.0	4.8	25.5	0.22	0.67
Soybean meal								
38–43 per cent protein	7.8	5.8	41.7	5.8	6.2	32.7	0.29	0.67
43–48 per cent protein	8.2	6.0	44.7	4.6	5.8	30.7	0.34	0.71

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(*Continued*)

Grains, Seeds, and Mill Concentrates —(*Continued*)

Feedstuff	Moisture	Ash	Crude protein	Ether extract †	Crude fiber	Nitrogen free extract ‡	Calcium §	Phosphorus §
Sunflower seed	6.9	3.2	15.2	28.8	28.5	17.4		
Sunflower hulls	10.5	2.6	4.4	3.4	57.0	22.1		
Sunflower kernels	6.9	4.2	29.4	43.9	2.6	13.0		
Velvet beans	9.8	3.1	26.2	4.8	6.0	50.1		
Vinegar grains	6.8	2.9	19.5	7.0	17.3	46.5		
Wheat	10.6	1.8	12.0	2.0	2.0	71.6	0.05	0.38
Wheat bran	9.4	6.4	16.4	4.4	9.9	53.5	0.10	1.14
Wheat, brown shorts	10.8	4.0	17.8	4.8	5.8	56.8		
Wheat flour middlings	10.4	3.3	18.8	4.0	4.2	59.3	0.09	0.80
Wheat, gray shorts	11.0	4.1	17.5	4.4	5.4	57.6	0.08	0.86
Wheat, mixed feed	9.9	4.4	18.2	4.4	6.9	56.1	0.11	0.96
Wheat, red dog	11.1	2.2	18.3	3.4	2.3	62.7	0.12	0.83
Wheat, standard middlings	10.4	3.9	17.0	4.3	5.4	59.0	0.09	0.90
Wheat, white shorts	10.9	2.2	15.6	3.7	2.4	65.2		
Wheat waste shredded	8.0	1.6	12.4	1.6	2.6	73.8		
Yeast cells, dried	4.3	10.7	48.5	0.5	0.5	35.5	0.42	1.90
Animal, Marine and Milk Products								
Beef meal	8.0	13.0	70.6	9.1	0	0		
Blood meal	14.4	4.7	78.4	0.6	0.8	1.1	0.35	0.24
Bone, green, horse	59.0	20.4	19.2	0.4	0	0		
Bone, green, butcher-shop	52.0	16.3	16.6	17.0	0	0		
Bonemeal, raw	6.7	62.1	25.2	3.3	1.4	1.3	24.2	11.5
Bonemeal steamed	3.1	83.6	6.2	2.2	1.3	3.6	30.0	13.9
Bonemeal, special steamed	2.7	75.1	11.1	6.5	1.7	2.9	27.0	13.2
Buttermilk	91.0	0.7	3.0	0.5		4.8	0.13	0.09
Buttermilk, dried	5.5	9.4	34.3	7.0	0.3	43.5	1.32	0.93
Crab meal	8.4	37.1	37.9	3.1	8.4	5.1		
Fish meal	7.1	17.7	62.0	7.3	0.6	5.3	4.31	2.68
Fish meal, menhaden	7.1	25.7	57.8	6.2	2.4	0.8		
Fish meal, sardine	6.7	13.4	68.1	4.3	0.5	7.0		
Fish, whiting	71.0	5.4	18.8	4.0	1.7	0		
Lips, ox	71.0	1.5	19.0	9.5	0	0		
Liver, hog	72.8		19.8	5.3	0	0		
Liver meal	6.4	7.5	67.2	14.6	1.9	2.4		
Lungs, beef	79.7	1.0	16.1	3.2	0	0		
Lungs, calf	76.8	1.1	16.1	5.0	0	0		
Meat, horse muscle	75.0	1.1	20.2	2.9	0	0		
Meat, beef muscle	72.0	1.0	21.2	5.2	0	0		

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(*Continued*)

Animal Marine, and Milk Products —(*Continued*)

Feedstuff	Mois ture	Ash	Crude pro-tein	Ether ex-tract†	Crude fiber	Nitro gen free ex-tract‡	Cal-cium §	Phos pho rus §
Meat and bone scraps								
42–48 per cent protein	6 1	31 6	46 8	11 8	2 1	1 6	11 2	5 06
48–53 per cent protein	6 4	30 5	50 4	9 7	2 0	1 0	10 5	5 21
53–58 per cent protein	6 1	25 5	54 9	11 1	2 1	0 3	8 26	4 02
Meat scraps								
48–53 per cent protein	5 7	28 0	51 0	12 0	1 6	1 7		
53–58 per cent protein	6 3	26 7	55 0	9 1	2 2	0 7	8 70	4 30
Melts beef	75 0	1 5	19 0	2 0	0	0		
Melts pork	78 0	1 5	17 5	2 0	0	0		
Milk, skim	91 1	0 8	3 4	0 2	0	4 5	0 13	0 10
Milk, skim, dried	4 7	8 8	35 8	1 0	0 1	49 6	1 34	0 99
Milk, whole	87 1	0 7	3 6	3 7	0	4 9	0 12	0 09
Shrimp meal	10 7	33 4	38 5	2 6	11 7	3 1	7 71	1 31
Tankage, digester								
53–58 per cent protein	7 6	21 8	55 8	10 4	2 5	1 9	8 92	4 22
over 58 per cent protein	6 8	19 5	61 6	8 6	1 7	1 8	7 07	3 72
Tankage, digester with bone								
38–43 per cent protein	6 4	32 4	40 0	14 1	3 0	4 1		
43–48 per cent protein	6 3	31 3	46 0	12 5	1 9	2 0		
48–53 per cent protein	5 8	28 6	51 2	10 4	1 6	2 4		
over 53 per cent protein	6 2	24 2	54 5	10 3	1 7	3 1	9 24	4 15
Tripe, raw	86 5	0 3	11 7	1 2	0	0 3		
Viscera, horse (includes blood)	77 0	1 1	19 8	1 2	0	0		
Whey	93 8	0 4	0 6	0 1	0	5 1	0 04	0 04
Whey, dried	6 7	10 1	12 8	0 6	0 2	69 6	0 73	0 66
Green Forages								
Alfalfa, immature	79 4	2 9	5 2	0 7	3 8	8 0	0 28	0 09
Alfalfa, in bloom	77 2	1 8	3 2	0 6	7 8	9 4	0 39	0 07
Alsike clover, immature	81 2	2 4	4 9	0 6	3 1	7 8	0 26	0 09
Alsike clover, in bloom	74 8	2 0	3 9	0 9	7 4	11 0	0 21	0 06
Barley, immature	83 4	1 5	2 8	0 7	3 6	8 0	0 06	0 07
Barley, mature	77 1	1 6	2 2	0 5	6 4	12 2	0 05	0 07
Bluegrass, Kentucky, immature	70 5	2 5	5 0	1 2	7 5	13 3	0 15	0 13
Bromegrass, immature	77 5	2 9	4 3	0 9	5 2	9 2	0 14	0 10
Cabbage	90 5	0 9	2 4	0 3	1 2	4 7	0 06	0 02
Canada bluegrass immature	74 1	2 5	4 3	1 3	6 8	11 0	0 11	0 12

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(*Continued*)

Green Forages —(*Continued*)

Feedstuff	Moisture	Ash	Crude protein	Ether extract †	Crude fiber	Nitrogen-free extract ‡	Calcium §	Phosphorus §
Corn fodder								
dent, immature	79.0	1.2	1.7	0.5	5.6	12.0		
dent, mature	73.4	1.5	2.0	0.9	6.7	15.5		
flint, immature	79.8	1.1	2.0	0.7	4.3	12.1		
flint, mature	77.1	1.1	2.1	0.8	4.3	14.6		
Cowpeas	82.5	2.5	3.4	0.5	4.0	7.1	0.18	0.05
Crimson clover	80.9	1.7	3.1	0.7	5.2	8.4	0.28	0.04
Kafir	73.0	2.0	2.3	0.7	6.9	15.1		
Lespedeza, Korean, immature	74.1	2.4	4.6	0.8	5.8	12.3	0.34	0.11
Meadow fescue, immature	78.8	2.6	4.0	0.9	4.7	9.0	0.15	0.11
Meadow foxtail, immature	73.9	2.8	4.5	1.2	5.6	12.0	0.15	0.12
Millet, foxtail	71.1	1.7	3.1	0.7	9.2	14.2	0.09	0.05
Oatgrass, tall, immature	78.4	3.0	4.3	1.0	4.6	8.7	0.11	0.13
Oats, immature	82.6	1.7	2.9	0.7	3.3	8.8	0.07	0.07
Oats, mature	72.0	2.1	2.7	0.9	7.4	14.9	0.08	0.08
Orchard grass, immature	78.3	2.8	3.4	1.0	5.3	9.2	0.14	0.13
Orchard grass, in bloom	73.0	2.0	2.6	0.9	8.2	13.3		
Prickly pear	78.9	4.3	0.7	0.4	2.6	13.1		
Rape	85.7	2.0	2.4	0.6	2.2	7.1		
Red clover, immature	81.2	2.7	5.0	0.8	3.0	7.3	0.27	0.10
Red clover, in bloom	70.8	2.1	4.4	1.1	8.1	13.5	0.44	0.07
Red fescue, immature	70.5	2.8	4.1	0.9	8.2	13.5	0.16	0.13
Red top, immature	76.8	2.8	4.1	0.9	5.4	10.0	0.15	0.10
Reed canary grass immature	80.7	2.4	3.5	0.7	4.3	8.4	0.13	0.10
Rye, immature	80.8	2.3	4.5	1.1	3.4	7.9	0.10	0.10
Rye, mature	76.6	1.8	2.6	0.6	11.6	6.8	0.08	0.06
Rye grass, Italian, immature	77.3	2.5	3.5	1.0	5.2	10.5	0.13	0.12
Rye grass, perennial, immature	75.9	3.0	3.8	0.9	5.4	11.0	0.15	0.12
Sorgo	77.3	1.3	1.5	1.0	6.2	12.7		
Soybeans	73.9	2.9	4.0	1.1	7.6	10.5	0.28	0.05
Sweet clover, immature	75.3	2.2	5.3	0.7	6.7	9.8	0.26	0.07
Sweet corn	79.1	1.3	1.9	0.5	4.4	12.8		
Timothy, immature	74.9	2.3	4.1	0.9	5.4	12.4	0.12	0.11
Timothy in bloom	61.6	2.1	3.1	1.2	11.8	20.2	0.13	0.05
Wheat, immature	82.3	2.1	3.8	0.9	3.0	7.9	0.07	0.10
Wheat, mature	68.7	2.6	2.4	0.7	8.6	17.0	0.06	0.08
White clover, immature	82.0	2.1	4.9	0.6	3.1	7.3	0.23	0.09
White clover, wild, immature	81.2	2.2	5.2	0.6	2.9	7.9	0.25	0.10

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(*Continued*)

Dried Forages

Feedstuff	Moisture	Ash	Crude protein	Ether extract†	Crude fiber	Nitrogen free extract‡	Calcium§	Phosphorus§
Alfalfa hay	7 2	8 0	15 4	1 6	30 3	37 5	1 51	0 21
Alfalfa leaf meal	8 5	14 4	20 9	2 6	15 7	37 9	1 42	0 25
Alfalfa meal	8 2	10 0	15 2	2 2	27 5	36 9	1 56	0 22
Alfalfa meal, dehydrated	6 6	10 0	16 9	2 6	25 4	38 5		
Alfalfa stem meal	9 1	7 7	11 4	1 3	36 1	34 4		
Alsike clover hay	10 5	8 8	14 4	2 5	24 7	39 1	0 78	0 20
Australian saltbush hay	6 7	16 9	16 1	1 8	21 5	37 0		
Barley hay	15 0	6 4	6 7	1 6	21 4	48 9	0 17	0 25
Barley straw	14 2	5 7	3 5	1 5	36 0	39 1		
Bermuda grass hay	8 9	7 9	7 2	1 7	24 9	49 4	0 60	0 16
Black grama hay	5 5	7 0	4 3	1 3	31 4	50 5	0 22	0 09
Blue grama hay	10 9	8 5	6 7	1 8	27 9	44 2		
Bluegrass hay, immature	7 3	7 9	15 2	3 0	23 7	42 9	0 45	0 35
Bluegrass hay, bloom	11 9	7 0	9 3	3 4	27 9	40 5	0 30	0 21
Bluejoint grass hay	7 5	6 9	6 7	3 0	34 2	41 7		
Bromegrass hay	14 0	9 7	9 3	1 8	26 6	38 6		
Buckwheat straw	9 9	5 5	5 2	1 3	43 0	35 1		
Buffalo grass hay	6 2	10 8	5 6	1 7	26 1	49 6		
Bur-clover hay	8 7	12 3	15 7	3 0	25 5	34 8	1 11	1 15
Corncobs	10 7	1 4	2 4	0 5	30 1	54 9		
Corn fodder	11 8	5 8	7 4	2 4	23 0	49 6		
Corn husks	9 8	2 9	2 9	0 7	30 7	53 0		
Corn leaves	11 8	8 5	8 1	2 2	24 4	45 0		
Cornstalks	11 7	4 6	4 8	1 8	32 7	44 4		
Corn stover	10 7	6 1	5 7	1 5	30 3	45 7	0 45	0 10
Cowpea hay	9 7	12 9	17 5	2 8	20 5	36 6	1 84	0 25
Cowpea straw	9 7	5 3	7 4	1 3	41 5	34 8		
Crabgrass hay	9 0	7 9	6 5	2 2	32 1	42 3	0 33	0 17
Crimson clover hay	9 6	8 6	15 2	2 8	27 2	36 6	1 18	0 13
Feterita fodder	13 3	6 4	8 7	1 9	21 5	48 2	0 27	0 19
Field pea hay	10 6	8 3	16 1	2 7	24 8	37 5		
Flax straw	6 2	3 8	7 8	2 1	46 9	33 2		
Hegari fodder	13 5	8 2	6 2	1 7	16 7	53 7	0 17	0 18
Hegari stover	15 1	9 7	4 5	1 9	26 6	42 2	0 38	0 09
Johnson grass hay	7 2	7 2	8 1	2 8	30 4	44 3	0 55	0 40
Kafir fodder	9 1	7 8	6 6	2 1	28 4	46 0	0 31	0 05
Kafir stover	12 6	9 0	5 8	1 7	27 5	43 4		
Lespedeza hay	7 9	6 2	11 9	2 8	28 5	42 7	0 80	0 25
Little bluestem hay	8 6	4 9	4 0	1 6	35 4	45 5		
Meadow fescue hay	11 6	7 0	6 6	2 0	31 6	41 2		

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(Continued)

Dried Forages —(Continued)

Feedstuff	Moisture	Ash	Crude protein	Ether extract †	Crude fiber	Nitrogen-free extract ‡	Calcium §	Phosphorus §
Millet hay, foxtail	7.0	8.2	9.2	2.8	28.0	44.8		
Millet hay, pearl or cattail	10.1	9.7	9.0	1.8	32.3	37.1		
Natal grass hay	7.5	4.8	3.7	1.4	39.5	43.1	0.49	0.32
Oatgrass tall, hay	8.1	6.4	9.4	2.7	29.8	43.6		
Oat hay	11.8	5.7	6.1	2.4	27.1	46.9	0.27	0.22
Oat straw	8.1	7.6	4.4	2.5	36.2	41.2	0.23	0.20
Orchard grass hay, immature	9.9	6.0	8.1	2.6	32.4	41.0	0.31	0.18
Orchard-grass hay, mature	9.9	7.0	6.9	3.0	32.7	40.5		
Prairie hay (Colorado, Wyoming)	5.5	7.2	7.0	2.4	31.3	46.6		
Prairie hay (Kansas, Oklahoma)	9.5	7.5	4.4	2.3	30.4	45.9	0.55	0.07
Prairie hay (Minnesota South Dakota)	11.6	7.2	6.0	2.4	30.3	42.5	0.44	0.11
Red-clover hay	7.0	10.0	16.1	2.6	23.6	40.7	1.01	0.14
Red clover, mammoth hay	12.2	7.5	12.8	3.3	27.1	37.1		
Red top hay	8.9	5.2	7.9	1.9	28.6	47.5	0.35	0.18
Rhodes grass hay	8.6	8.4	5.3	1.2	33.4	43.1		
Rice straw	8.9	13.5	4.5	1.6	34.0	37.5	0.18	0.05
Rye hay	6.4	4.7	5.9	2.0	37.4	43.6	0.27	0.22
Rye straw	7.1	3.2	3.0	1.2	38.9	46.6		
Rye grass perennial, hay	10.2	8.6	8.6	4.1	24.5	44.0	0.17	0.11
Rye grass, Italian, hay	8.5	6.9	7.5	1.7	30.5	44.9		
Rye-grass hay	8.3	8.5	6.3	2.0	33.0	41.9		
Sedge, western species	5.4	6.7	11.6	2.4	27.4	46.5		
Slender wheatgrass	7.5	6.6	7.8	2.1	30.8	45.2		
Sorgo fodder	11.6	6.0	5.3	2.4	26.0	48.7	0.27	0.15
Sorgo hay	5.8	9.5	9.5	1.9	26.8	46.5	0.31	0.09
Soybean hay	8.4	8.9	15.8	3.8	24.3	38.8	1.26	0.22
Soybean straw	8.7	7.4	5.7	2.5	34.6	41.1		
Sudan grass hay	5.3	8.1	9.7	1.7	27.9	47.3	0.47	0.24
Sweet-clover hay	8.1	7.5	16.2	2.8	25.9	39.5	0.74	0.08
Sweet-clover straw	5.1	3.4	6.7	1.2	49.6	34.0		
Timothy hay	7.1	5.8	7.5	2.9	30.2	46.5	0.31	0.13
Vetch, hairy hay	13.1	8.4	20.9	2.7	24.2	30.7	0.25	0.30
Western needlegrass hay	9.9	6.2	5.5	2.7	33.2	42.5		
Western wheatgrass hay	8.6	8.7	8.4	2.3	31.9	40.1		
Wheat hay	9.6	4.2	3.4	1.3	38.1	43.4	0.14	0.15
Wheat straw	6.8	5.4	4.3	3.4	36.8	43.3		

TABLE 55 THE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED IN ANIMAL FEEDING *—(*Continued*)

Dried Forages —(*Continued*)

Feedstuff	Moisture	Ash	Crude protein	Ether extract†	Crude fiber	Nitrogen-free extract‡	Calcium§	Phosphorus§
White clover hay	7 2	9 4	15 6	2 2	22 7	42 9	1 31	0 28
Wire grass hay	8 5	7 3	6 6	1 3	34 6	41 7		
Silages, Roots, Tubers, and By products								
Alfalfa silage	68 9	2 7	5 7	1 0	8 8	12 9		
Alfalfa molasses silage	68 6	3 4	5 8	1 0	8 4	12 8		
Apple pomace	78 6	0 6	1 3	1 2	3 7	14 6	0 02	0 01
Apple silage	87 6	0 6	0 7	0 7	1 8	8 6		
Beet pulp, dried	9 2	3 2	9 3	0 8	20 0	57 5	0 66	0 06
Beet pulp, molasses, dried	8 0	5 2	11 6	0 7	16 4	58 1	0 59	0 09
Carrots	88 6	1 0	1 1	0 4	1 3	7 6		
Cassava	63 8	1 4	1 0	0 3	0 8	32 7		
Corn silage	73 8	1 7	2 1	0 8	6 3	15 3	0 08	0 08
Corn silage, immature	79 1	1 4	1 7	0 8	6 0	11 0		
Corn silage, mature	70 9	1 4	2 4	0 9	6 9	17 5		
Corn stover silage	80 7	1 8	1 8	0 6	5 6	9 6		
Cow pea silage	77 8	2 1	3 2	0 9	6 5	9 5		
Hegari silage	66 3	3 4	2 3	0 8	6 7	20 5		
Jerusalem artichokes	78 7	1 1	2 5	0 2	0 8	16 7		
Mangel wurzel	90 8	1 0	1 4	0 2	0 9	5 7	0 02	0 02
Napier grass silage	67 5	1 8	1 2	0 7	14 4	14 4	0 10	0 10
Parsnips	80 0	1 3	2 2	0 4	1 3	14 8		
Pea vine silage	75 1	1 7	3 0	0 9	8 1	11 2		
Potatoes	78 9	1 0	2 1	0 1	0 6	17 3	0 01	0 06
Red clover silage	72 0	2 6	4 2	1 2	8 4	11 6		
Rutabagas	88 6	1 2	1 2	0 2	1 3	7 5	0 05	0 04
Sorgo silage	74 7	1 4	1 6	1 0	6 9	14 4	0 09	0 04
Soybean silage	75 6	2 6	2 4	0 8	9 6	9 0	0 29	0 10
Sugar beets	78 0	1 0	1 5	0 1	2 9	16 5	0 05	0 06
Sugar beet pulp	90 5	0 4	0 9	0 2	2 2	5 8		
Sunflower silage	77 9	2 1	1 8	1 6	6 5	10 1		
Sweet-clover silage	70 2	2 9	6 1	1 0	9 7	10 1		
Sweet potatoes	71 1	1 0	1 5	0 4	1 3	24 7	0 02	0 05
Turnips	90 6	0 8	1 3	0 2	1 2	5 9	0 05	0 05

* From Better Feeding of Livestock *Misc Circ* 12 U.S.D.A., 1942.
† Fat
‡ Carbohydrates except fiber
§ Blank spaces indicate that data are lacking

Appendix II

Measuring Stored Grain, Hay, and Silage

LIVESTOCK raisers frequently have occasion to compute or estimate quantities of feed in terms of bushels, pounds, or tons The following suggestions provide short cuts for making these computations or estimates

Measuring Grain in Storage

To find the number of bushels of grain or shelled corn in a bin, multiply the length by the width by the average depth (all in feet) and divide by 1¼

If the crib is round, secure the radius in feet by taking one half the diameter (in feet) Square the radius and multiply by 3 1416 Multiply this product by the height in feet and divide by 1¼

In case of ear corn, divide the volume in either case by 2½

Tons of Hay in a Mow

To find the number of tons of loose hay in a mow multiply the length by the width by the height (all in feet) and divide by 400 to 500, depending on the kind of hay and how long it has been in the mow

Tons of Hay in a Stack

To find the number of tons of loose hay in a stack, multiply the overthrow (the distance from the ground on one side over top of stack to the ground on the other side) by the length by the width (all in feet), multiply by 3, divide by 10 and then divide by 500 to 600, depending on the kind of hay and how long it has been in stack

Estimating Amount of Silage Remaining in Silo

What is left in a silo after part has been used can be estimated as follows

Find the original amount of silage put in the silo by referring to Table 56 Find the amount of silage that has been used by the same method,

TABLE 56. CAPACITY OF SILOS, TONS

Depth of silage after settling two days, feet	Inside diameter of silo in feet					
	10	12	14	16	18	20
2	2	2	3	4	5	6
4	3	5	7	9	11	13
6	5	8	11	14	17	21
8	8	11	15	20	25	31
10	10	15	20	26	33	41
12	13	19	25	33	42	52
14	16	23	31	41	52	64
15	18	25	34	45	57	70
16	19	28	38	49	62	77
17	21	30	41	53	67	83
18	23	32	44	58	73	90
19	24	35	48	62	79	97
20	26	38	51	67	85	105
21	28	40	55	72	91	112
22	30	43	59	77	97	120
23	32	46	63	82	103	128
24	34	49	66	87	110	135
25	36	52	70	92	116	143
26	38	55	74	97	123	152
27	40	58	79	103	130	160
28	42	61	83	108	137	169
29	44	64	87	114	144	178
30	47	67	91	119	151	187
31	49	70	96	125	158	195
32	51	74	100	131	166	205
33	53	77	105	138	173	214
34	56	80	109	143	181	224
35	58	84	114	149	188	232
36	61	87	118	155	196	242
37	63	90	123	161	204	252
38	66	94	128	167	212	262
39	68	97	133	174	221	272
40	70	101	138	180	229	280

using as depth the difference between present depth and depth two days after filling. Subtract the amount used from original amount. The difference is the approximate amount of silage remaining in silo.

Example: A silo 16 ft. in diameter and 32 ft. high was filled so that after settling two days there were 26 ft. of silage. At the time inventory was taken, there were 12 ft. of silage left. From the table it is seen that 26 ft. of silage in a 16-ft. silo equals 97 tons. Since 12 ft. of silage were left, 14 ft. had been fed, and 14 ft. of silage in a 16-ft. silo equals 41 tons.

Therefore, the bottom 12 ft of silage in this silo would contain about 56 tons of silage, since 97 tons minus 41 tons equals 56 tons

Weights and Measures of Common Feeds

In calculating rations it is usually necessary to use weights rather than measures However, it is often easier to measure concentrates Table 57 makes this possible

TABLE 57

Feed	Weight of 1 qt, lb, approximate to ¼ lb	Approximate weight of 1 bushel, lb
Alfalfa feed	¾	25
Barley	1½	48
Beet pulp, dried	½	19
Brewers grains, dried	½	19
Buckwheat	1½	50
Buckwheat bran	1	29
Charcoal	½	20
Corn husked ear		70
Corn, cracked	1½	50
Corn shelled	1¾	56
Corn meal	1½	50
Corn and-cob meal	1½	45
Cottonseed meal	1½	48
Cowpeas	2	60
Distillers grains dried	½	19
Fish meal	1	35
Gluten feed	1¼	42
Linseed meal old process	1	29
Linseed meal new process	1	35
Meat scrap	1¼	42
Molasses feed	¾	26
Oats	1	32
Oats ground	¾	22
Oat middlings	1½	48
Peanut meal	1	29
Rice bran	¾	26
Rye	1¾	56
Soybeans	1¾	62
Tankage	1¼	40
Velvet beans shelled	1½	60
Wheat	2	60
Wheat bran	½	19
Wheat middlings standard	¾	26
Wheat screenings	1	32

Appendix III

Addresses of the Secretaries of Purebred Livestock Registry Associations

LIVESTOCK registry associations are the official organizations for the particular breeds they represent These associations provide headquarters for registering and transferring the pedigrees of purebred animals and for distributing descriptive literature about particular breeds The names of various livestock registry associations and the addresses of their secretaries are listed below

Addresses of the Secretaries of Purebred Livestock Registry Associations

SWINE

American Poland China Record Association, Union Stockyards, Chicago, Ill
The National Poland China Record Association, Winchester, Ind
The Standard Poland China Record Association, Marysville, Mo
The National Spotted Poland China Record Association, Indianapolis, Ind
The American Spotted Poland China Record Association, Moberly, Mo
The United Duroc Record Association, Peoria, Ill
The Chester White Record Association, Rochester, Ind
The Breeders' Chester White Record Association, Coin, Iowa
The American Hampshire Swine Record Association, Peoria, Ill
The American Berkshire Association, Springfield, Ill
The American Yorkshire Club, Lafayette, Ind
The American Tamworth Swine Record Association Hagerston, Ind
The National Hereford Hog Record Association, Chariton, Iowa
The O I C Swine Association, Brookville, Ohio
The O I C Swine Breeders' Association, Goshen, Ind
Inbred Livestock Registry Association, University Farm, St Paul, Minn

DAIRY

The Holstein Friesian Association of America, Brattleboro, Vt
The American Jersey Cattle Club, Columbus, Ohio
The American Guernsey Cattle Club, Peterborough, N H
American Ayrshire Breeders' Association, Brandon, Vt.
The Brown Swiss Breeders' Association, Beloit, Wis

BEEF CATTLE

The American Shorthorn Breeders' Association, Union Stockyards, Chicago, Ill
The American Hereford Breeders' Association, Kansas City, Mo
The American Polled Hereford Breeders' Association Des Moines, Iowa
The American Aberdeen Angus Breeders' Association, Union Stockyards, Chicago, Ill
The American Brahman Breeders' Association Houston, Texas

DUAL-PURPOSE CATTLE

The American Shorthorn Breeders' Association (*Milking* Shorthorn), Union Stockyards, Chicago, Ill
The Red Poll Cattle Club of America, Lincoln, Neb

SHEEP

American Rambouillet Sheep Breeders' Association San Angelo, Texas
The American and Delaine Merino Record Association, Wooster, Ohio
The American Shropshire Registry Association Lafayette Ind
The American Hampshire Sheep Registry Association 72 Woodland Ave, Detroit, Mich
The American Southdown Sheep Breeders' Association, State College, Pa
The American Dorset Sheep Registry Association Hickory, Pa
The American Cheviot Sheep Registry Association Oneonta, N Y
The American Suffolk Sheep Society, Moscow, Idaho
American Oxford Sheep Registry Association, Clayton, Ind
The Columbia Sheep Breeders' Association, Logan, Utah
The American Cotswold Sheep Registry Association, Union Stockyards, Chicago Ill
The American Lincoln Sheep Registry Association, Marlette, Mich
The American Leicester Sheep Registry Association, Cameron, Mo
The National Corriedale Sheep Registry Association, Union Stockyards, Chicago Ill
The American Corriedale Association, Columbia, Mo
The American Romney Sheep Breeders' Association, Corvallis, Ore

The Karakul Fur Sheep Registry, Friendship, Wis.
The United Karakul Registry, Twin Falls, Idaho.
The National Suffolk Sheep Association, Middleville, Mich.
The Montadale Sheep Breeders' Association, St. Louis, Mo.

GOATS

The American Angora Goat Breeders' Association, Rock Springs, Texas.
The American Milk Goat Record Association, Ipswich, Mass.
The International Nubian Goat Breeders' Association, La Jolla, Calif.

HORSES

The Percheron Horse Association of America, Union Stockyards, Chicago, Ill.
The Belgian Draft Horse Corporation of America, Wabash, Ind.
The American Clydesdale Association, Union Stockyards, Chicago, Ill.
The American Shire Horse Breeders' Association, 319 East 4th St., Des Moines, Iowa.
The American Suffolk Horse Association, Clinton, N.J.
The Jockey Club (Thoroughbreds), 250 Park Ave., New York, N.Y.
The American Saddle Horse Breeders' Association, Louisville, Ky.
The American Trotting Register, Goshen, N.Y.
The Arabian Horse Club of America, 111 West Monroe St., Chicago, Ill.
The American Shetland Pony Club, South Bend, Ind.
The American Quarter Horse Association, Amarillo, Texas.
The Tennessee Walking Horse Breeders' Association of America, Lewisburg, Tenn.
The Palomino Horse Breeders of America, Mineral Wells, Texas.
The Morgan Horse Club, 90 Broad St., New York, N.Y.
The Welsh Pony and Cob Society of America, Ann Arbor, Mich.
The American Hackney Horse Society, 42 Broadway, New York, N.Y.
The Morocco Spotted Horse Cooperative Association of America, Greenfield, Iowa.

JACKS AND JENNETS

The Standard Jack and Jennet Registry of America, Garden City, Kans.

Livestock and Breed Journals

SWINE

The Yorkshire Journal, Lafayette, Ind.
The Poland China World, Des Moines, Iowa.
The Hampshire Herdsman, Peoria, Ill.
Hog Breeder, Peoria, Ill.

The OIC News, Goshen, Ind
Canadian Swine, Weston, Ontario, Canada
The Duroc News, Peoria, Ill
The Chester White Journal Rochester Ind
The Poland China Journal, Kansas City, Mo
The Swine World Webster City, Iowa
The Berkshire News, Springfield, Ill
Poland China World, Waverly, Iowa
The Spotted Poland China Bulletin, Indianapolis, Ind
Hereford Swine Journal, Chariton Iowa
The Poland China Breeder, Grandview, Mo

DAIRY CATTLE

Holstein Friesian World, Lacona, N Y
The Jersey Bulletin, Indianapolis, Ind
The Guernsey Breeders' Journal, Peterborough, N H
The Ayrshire Digest, Brandon, Vt
The Brown Swiss Bulletin, Beloit, Wis
Hoards Dairyman, Ft Atkinson, Wis

BEEF CATTLE

The Shorthorn World, Aurora, Ill
The American Hereford Journal, Kansas City Mo
The Aberdeen Angus Journal, Webster City Iowa
The American Brahman Journal Houston, Texas
American Cattle Producer, Denver, Col
The Cattleman, Ft Worth, Texas

DUAL PURPOSE CATTLE

Milking Shorthorn Journal Springfield Mo
The Red Polled News, Lincoln Neb

SHEEP AND GOATS

Sheep and Goat Raiser, El Paso, Texas
The National Wool Grower, Salt Lake City, Utah
The Sheepman, Lexington, Ky
The Sheep Breeder, Columbia, Mo
The Southwestern Sheep and Goat Raiser, San Angelo, Texas
Dairy Goat Journal, Columbia, Mo

HORSES

The Quarter Horse Journal, Amarillo, Texas
The Belgian Review, Wabash, Ind

The Percheron Review, Union Stockyards, Chicago, Ill.
The Horse and Horseman, New York, N.Y.
Saddle and Bridle, St. Louis, Mo.
The American Racing Manual, Chicago, Ill.
The Morgan Horse Magazine, 90 Broad St., New York, N.Y.
The Thoroughbred Record, Lexington, Ky.

GENERAL LIVESTOCK

Breeders Gazette, Spencer, Ind.
Texas Livestock Journal, San Antonio, Texas.
National Livestock Producer, Chicago, Ill.
Western Livestock Journal, Los Angeles, Calif.
The Breeder-Stockman, Warrenton, Va.

Appendix IV
Correlated List of Visual Aids

THE MOTION pictures and filmstrips listed in this visual bibliography can be used to supplement the material in this book. It is recommended, however, that each film be reviewed before using in order to determine its suitability for a particular group.

Both motion pictures (MP) and filmstrips (FS) are included in this visual bibliography, and the character of each one is indicated by the self-explanatory abbreviations. Immediately following this identification is the name of the producer, and if the distributor is different from the producer, the name of the distributor follows the name of the producer. Abbreviations are used for names of producers and distributors and these abbreviations are identified in the list of addresses at the end of the bibliography. In most instances the films listed can be borrowed or rented from local or state 16mm film libraries. A list of such sources is contained in *A Directory of 2002 16mm Film Libraries*, which may be obtained from the Superintendent of Documents, Washington 25, D.C. Unless otherwise indicated, the motion pictures are 16mm sound, black and white films and the filmstrips are 35mm silent and black and white.

For the convenience of film users the films have been grouped by the subjects treated in the various chapters, but in some instances the same film may be used in connection with several different chapters.

This bibliography is suggestive only, and film users should examine the latest annual edition and quarterly supplements of *Educational Film Guide*, a catalog of some 10,000 films published by the H. W. Wilson Company, New York. The *Guide*, a standard reference book, is available in most college and public libraries.

Chapter 1 Engaging in the Livestock Business

Dairy Industry (MP, VGF, 11min). Explains the operations of the dairy industry both on the farm and in a processing plant, and discusses the qualifications needed by and the opportunities open to people in this industry.

Livestock and Mankind (MP, USDA, 11min). Explains how animal husbandry and veterinary science have increased the usefulness of domestic animals to mankind, and shows the work of the U.S. Department of Agriculture in the field of animal industry.

Chapter 2. Selecting Livestock

Breeds of Sheep (FS USDA/Photo 56 frames). Illustrates how breeds of sheep are classified on the basis of fine, medium, or coarse wool, and karakul fur.

Breeds of Swine (FS USDA/Photo 33 frames). Pictures several breeds of swine commonly used in producing market hogs in the United States; compares lard and bacon types.

Livestock and Dairy Judging (FS Pop Sci 182 frames color). Consists of five filmstrips, with titles as follows, devoted to the prints emphasized in the judging of livestock:

Breeds of Beef Cattle (29 frames)
Judging Beef Steers (44 frames)
Judging Barrows (43 frames)
Judging Sheep (34 frames)
Judging Dairy Cattle (32 frames)

Chapter 3. Feeding Livestock

Farming for Facts (MP Gen Mills 24min color). A trip through the General Mills research farm near Detroit, showing the development of feeds and feeding methods for various types of farm animals.

Feeding and Care of the Dairy Calf (FS USDA/Photo 49 frames). Shows the housing, health, training, feeding, and earmarking of dairy calves from birth to full development.

Feeding Farm Animals (MP USDA 19min). Shows the basic principles of feeding farm animals; the six classes of nutrients (carbohydrates, fats, proteins, vitamins, minerals, and water); and the results of correct feeding.

Growth of a Nation (MP MTP [Am Feed] 20min). Traces the history of the science of feeding livestock, portrays good feeding practices, and explains research activities being carried on by the industry and government.

Man-made Miracles (MP Am Guernsey 30min color). Shows various types of cattle, dogs, and horses, and explains how man has developed these animals through breeding, training, and nutrition.

Marketing Feeds through Dairy Cows (FS USDA/Photo 31 frames). Shows various types of dairy cows, methods of determining their value, and the kinds of feeds to be used.

Pig Sense and Hog Dollars (MP Gen Mills 18min color). Explains the care of sows before and after farrowing, and brings out other points on the sanitation, housing, and feeding of swine. Emphasis is upon feeding.

Chapter 4 Providing Housing and Equipment for Livestock

Hog Houses and Equipment (FS USDA/Photo 30 frames) Illustrations of A type and box type houses, loading chutes, feeders, dipping vat, waterer, concrete wallow, and other equipment

How to Build a Hog Self Feeder (MP CNFB 6min) A farmer demonstrates how to make this piece of farm equipment

Producing Quality Milk (MP Milk Ind Ed/Assn 27min) Emphasizes the need for sanitation, and covers breeding, care of cows and barns, testing of milk, cleaning procedures, and types of equipment

Chapter 5. Caring for and Handling Livestock

More Milk (MP USDA 11min) Presents the need for increased milk production, especially from herds of a dozen cows or less and emphasizes the importance of scientific care and feeding

Ounce of Prevention (MP Sears/Venard 25min color) Demonstrates ways and means of preventing loss from improper care and handling of livestock Produced with the cooperation of the National Livestock Loss Prevention Board

Chapter 6 Keeping Livestock Healthy and Sound

Brucellosis of Cattle (Bang's Disease) (FS USDA/Photo 18 frames) History, symptoms, causes, and methods of controlling brucellosis

Cattle Grubs or Heel Flies (FS USDA/Photo 33 frames) Shows the seasonal and life cycles of the cattle grub its attack on cattle, and control measures suitable for farm and range herds

Control of Worms in Hogs (MP USDA 32min silent) Reviews the life history and shows methods of controlling internal parasites that infect hogs, including thorn headed worms nodular worms, stomach worms, roundworms lungworms, and kidney worms

Eradicating Tuberculosis from Livestock and Poultry (FS USDA/Photo 36 frames) Explains types of tubercle bacilli that cause disease in farm animals, tuberculin testing, effects of disease, and its prevention

Eradication of Foot and mouth Disease (FS USDA/Photo 33 frames) Shows symptoms of the disease, and the need to destroy diseased animals, to clean and disinfect the premises, and to report suspected cases to livestock authorities

Horses and Bots (MP USDA 30min silent) Shows three types of botflies, how they attack and affect horses and mules, methods of treating the affected animals and campaigns of eradication

Horse Bots and How to Fight Them (FS USDA/Photo 39 frames)

Explains the life cycle of botflies, their attack and effect upon horses, and methods of control.

Outbreak (MP USDA 30min color). Traces the history of foot-and-mouth disease; explains what happened in the 1929 outbreak in California; and shows the cooperative measures used by the Mexican and United States governments in combatting the outbreak of 1949.

Trichinosis, a Disease Easily Prevented (FS USDA/Photo 31 frames). Explains stages of the parasite, causes of the disease, and its spread and prevention.

Triple Threat of Brucellosis (MP USDA 27min color). Explains the incidence of brucellosis in the United States, and emphasizes the threat of this disease to cattle, swine, and human beings; shows the nature of brucellosis and its infection of animals and humans; and recommends four methods of control.

Tuberculosis in Poultry and Swine (MP USDA 20min). Discusses the occurrence of disease, especially in North Central states, and explains that it is transmissible from poultry to swine; describes the symptoms and the appearance of affected tissues; and recommends procedures for eradication.

Valiant Years (MP MTP [Assoc. Serum] 26min). Explains the work of veterinarians and their contributions to the livestock industry and discusses various animal diseases.

Vesicular Diseases of Animals (MP USDA 11min color). Shows typical condition of hogs affected with vesicular stomatitis. Photographed at the Animal Disease Station, Agricultural Research Center, Beltsville, Md.

Chapter 7. Breeding and Improving Livestock

Britain's Livestock (MP BIS 16min color). Traces the evolution of cattle breeding in Great Britain from early days down to the present time. Sponsored by the British Ministry of Agriculture.

Selection of Breeding Stock: Beef (FS Pop Sci 100 frames color). Consists of two filmstrips, 50 frames each, one devoted to the male and the other to the female, pointing out factors to be recognized in evaluating breeding characteristics. Produced in cooperation with Oklahoma A. and M. College.

Selection of Breeding Stock: Swine (FS Pop Sci 90 frames color). Consists of two filmstrips, 45 frames each, one devoted to the male and the other to the female, pointing out factors to be recognized in evaluating breeding characteristics. Produced in cooperation with Oklahoma A. and M. College.

Some Principles of Breeding Demonstrated with the Herediscope (FS

USDA/Photo 40 frames) Explains the fundamental laws of heredity, and demonstrates the use of the herediscope, a device designed by R. R Graves of the Bureau of Dairy Industry

Chapter 8 Keeping and Using Livestock Records

The Dairy Herd Improvement Association Identification and Permanent Record Program (FS USDA/Photo 38 frames) Explains the identification markings employed by the association methods of eartagging and the keeping of identification and production records

Chapter 9 Marketing Livestock and Livestock Products

Do unto Animals (MP USDA 22min) Shows shipping methods sponsored by the U S Department of Agriculture and the National Live stock Loss Prevention Board to reduce injuries to animals during shipment to market.

Frank Martin Dairyman (MP Westinghouse 15min color) Story of a dairyman and how bacteria in his milk caused by inadequate cool ng threatened to put him out of bus ness Emphasizes the *importance* of refrigeration

Handling Livestock for Market (MP USOE/UWF 21min) Causes of losses in marketing livestock how to prevent injuries to livestock on the farm before shipment when loading and during shipment (Correlated filmstrip same title 46 frames also available)

Livestock Cooperatives in Action (MP USDA 15min color) Traces the his ory and shows the services of livestock marketing cooperatives

Sheep Shearing (MP USOE/UWF 21min) How to handle sheep for shearing shearing the sheep step by step and rolling and tying the fleece (Correlated filmstrip same title 52 frames also available)

Today s Chisholm Trail (MP Am Stock Yds 25min color) Explains the functions of a stockyard and shows some of the services a stock yard offers to cattle producers and buyers

Wool Marketing and Manufacture (MP USDA 45min silent) Shows the handl ng of wool from herd to market and manufacture—shearing of sheep sh pment of fleece grad ng of wool milling of wool and weaving of yarn into cloth

Chapter 10 Preparing and Processing Livestock Products for Home Use

Canning Beef (MP USOE/UWF 17min) How to prepare soup stock preheat beef pack hot beef in cans seal the cans process canned beef and cool and dry the cans before packing (Correlated filmstrip same title 49 frames also available)

Canning Meat (FS USDA/Photo 40 frames). Shows how to can meat according to methods recommended by the Bureau of Human Nutrition and Home Economics.

Curing Pork Country Style (MP USDA 18min black and white with color sequences). Shows how to cure pork by the "dry" and "brine" methods; and gives instructions on the preparation, smoking, cooling, wrapping, and storage of meat.

Cutting and Boning a Forequarter of Beef (MP USOE/UWF 19min). How to chill beef; quarter it; trim the forequarter; cut wing, crosscut chuck, brisket, and chuck; and prepare meat for freezing or canning. (Correlated filmstrip, same title, 50 frames, also available.)

Cutting and Boning a Hindquarter of Beef (MP USOE/UWF 17min). How to separate the round from loin and rump, cut the round, remove the tenderloin, separate sirloin and rump from shell loin, and prepare meat for freezing or canning. (Correlated filmstrip, same title, 49 frames, also available.)

Pork on the Farm (MP USDA 21min). Shows approved methods of raising hogs for home use; techniques of killing, dressing, and handling to avoid spoilage; methods of cutting and curing; and advantage of cold storage.

Sources of Films Listed

Am Guernsey—The American Guernsey Cattle Club, Peterborough, N.H.

Am Stock Yds—American Stock Yards Assn., Terminal Tower, Cleveland 13, Ohio.

Assn—Association Films, Inc., 35 West 45th St., New York 19, N.Y.; 79 East Adams St., Chicago, Ill.; 1915 Live Oak St., Dallas, Tex.; 351 Turk St., San Francisco, Calif.

BIS—British Information Services, 30 Rockefeller Plaza, New York 20, N.Y.

CNFB—National Film Board of Canada, 1270 Avenue of the Americas, New York 20, N.Y.; 400 West Madison St., Chicago 6, Ill.

Gen Mills—General Mills, Inc., Film Library, 400 Second Ave., South, Minneapolis, Minn.

Milk Ind Fd—Milk Industry Foundation, Chrysler Bldg., New York 17, N.Y.

MTP—Modern Talking Picture Service, Inc., 45 Rockefeller Plaza, New York 20, N.Y.

Photo—Photo Lab, Inc., 3825 Georgia Ave., Washington 11, D.C.

Pop Sci—Popular Science Publishing Co., 353 Fourth Ave., New York 10, N.Y.

Sears—Sears, Roebuck Foundation, Chicago 7, Ill.

USDA—U S Department of Agriculture, Motion Picture Service, Wash ton 25, D C (Motion pictures loaned and rented by 16mm libraries, sold by United World Films Filmstrips sold by Photo L

USOE—U S Office of Education, Washington 25, D C (Films under a government contract by United World Films, and rentec 16mm film libraries that have purchased prints)

UWF—United World Films, Inc , 1145 Park Ave , New York 29, N Y

Venard—The Venard Organization Peoria 2, Ill

VGF—Vocational Guidance Films, 215 East 3d St , Des Moines, Iowa

Westinghouse—Westinghouse Electric Corp , Film Division, Pittsburgh

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